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THE BREEDING BIRD SURVEY

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UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
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Special Scientific Report --Wildlife No. 102

UNITED STATES DEPARTMENT OF THE INTERIOR, STEWART L. UDALL, *Secretary*
Stanley A. Cain, *Assistant Secretary for Fish and Wildlife and Parks*
Fish and Wildlife Service, Clarence F. Pautzke, *Commissioner*
Bureau of Sport Fisheries and Wildlife, John S. Gottschalk, *Director*

THE BREEDING BIRD SURVEY, 1966

By

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Division of Wildlife Research

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CONTENTS

	Page
ABSTRACT	iv
INTRODUCTION	1
METHODS	1
Selection of routes	1
Observer contacts	2
Coverage	2
Recording of data	3
Analysis of data	6
Sources of bias	6
Observer bias	7
Seasonal changes	9
Time of day	10
Weather	12
Distribution of Survey data	12
RESULTS	12
Population status	12
Population trends	22
Mapping of relative abundance	23
FUTURE PLANS	35
ACKNOWLEDGMENTS	36
List of cooperators	36
Breeding Bird Survey coordinators	40
REFERENCES	43

Figures

1.	Distribution of 1966 Breeding Bird Survey routes	3
2.	Field sheet for recording Breeding Bird Survey data	4
3.	Summary sheet for individual Survey routes	5
4.	Comparison of Indigo Bunting population on Maryland Route P-1 as recorded by 10 observers, 1965 and 1966	8
5.	Comparison of Blue Jay population on Maryland Route P-1 as recorded by 10 observers, 1965 and 1966	8
6.	Seasonal change in conspicuousness of Downy Woodpecker	9
7.	Effect of time of day	11
8.	Maryland population indices for 5 species, 1965-1966	22
9.	Portion of Rufous-sided Towhee distribution and abundance map prepared by UNIVAC 1004	23
10.	Bobwhite distribution, 1966	24
11.	Mourning Dove distribution, 1966	25
12.	Red-bellied Woodpecker distribution, 1966	26
13.	Carolina Wren distribution, 1966	27
14.	Mockingbird distribution, 1966	28
15.	Warbling Vireo distribution, 1966	29
16.	Prothonotary Warbler distribution, 1966	30
17.	Orchard Oriole distribution, 1966	31
18.	Blue Grosbeak distribution, 1966	32
19.	Rufous-sided Towhee distribution, 1966	33
20.	Grasshopper Sparrow distribution, 1966	34
21.	Song Sparrow distribution, 1966	35

ABSTRACT

A Breeding Bird Survey of a large section of North America was conducted during June 1966. Cooperators ran a total of 585 Survey routes in 26 eastern States and 4 Canadian Provinces. Future coverage of established routes will enable changes in the abundance of North American breeding birds to be measured.

Routes are selected at random on the basis of one-degree blocks of latitude and longitude. Each $24\frac{1}{2}$-mile route, with 3-minute stops spaced one-half mile apart, is driven by automobile. All birds heard or seen at the stops are recorded on special forms and the data are then transferred to machine punch cards.

The average number of birds per route is tabulated by State, along with the total number of each species and the percent of routes and stops upon which they were recorded. Maps are presented showing the range and abundance of selected species. Also, a year-to-year comparison is made of populations of selected species on Maryland routes in 1965 and 1966.

THE BREEDING BIRD SURVEY, 1966

The Breeding Bird Survey is designed to measure changes in abundance of North American breeding birds by surveying populations on a large number of randomly located roadside transects. In the past two decades we have witnessed a drastic change in land use, agricultural practices and environmental polution. With expanding human populations we can anticipate even greater intensity of land use and alteration of wildlife environments.

Except for a few rare and local species, no adequate method has existed for measuring population changes of non-game species on a continental basis. Even after 30 years of Audubon Breeding Bird Censuses we find that only 15 census areas were covered both in 1964 and 1965. This sample, comprising barely 500 acres, includes only small numbers of any one species, and many important species are not included at all.

METHODS

The method for the Breeding Bird Survey was developed over a period of 15 years using observations from 7 States and Provinces. It was given an intensive field test in Maryland and Delaware in June 1965. The Survey was expanded in 1966 to include all States east of the Mississippi River as well as the eastern Provinces of Canada.

Selection of Routes

Each State and Province was assigned a certain number of routes in each degree block of latitude and longitude, the number depending upon the best estimate of potential coverage. An attempt was made to have uniform density of coverage within a State or Province; but density varied from one State to another. Most States and Provinces were assigned at least 2 routes per degree block and there was a maximum density of 16 routes per block in Maryland and Delaware.

The starting point and direction for each route were determined in advance. In many States and Provinces marked maps were supplied to the observers. In other States only the starting point and direction were supplied and the actual route was mapped by the observer. In the future all observers will be provided with marked maps.

The starting points within each degree block were drawn from a table of random numbers, each number representing minutes of latitude and longitude. After locating the intersection of latitude and longitude on a map a conspicuous landmark on the nearest road was named as the starting point. The direction in which the route was to proceed was determined from the last digit in the minutes of latitude and longitude of the starting points. If both latitude and longitude ended in an even number the route proceeded to the north; if latitude was even and longitude was odd

the route went east; if latitude was odd and longitude was even the route proceeded south; and if both latitude and longitude ended in an odd number the route proceeded west.

Numbered Interstate, Federal and State highways were avoided as much as possible in order to reduce interference from traffic. Also, roads that might prove impassable in subsequent years were avoided. With these exceptions, each route proceeded as closely as possible in the prescribed direction unless or until it approached either a State line or a degree block boundary. If this happened, the direction of the route turned clockwise and the route continued until 50 stops were completed.

Although routes were laid out in advance wherever possible, provision was made for deviation from the prescribed route in the event of impassable roads or blockage of old roads by new highways. In order for the routes to be duplicated as closely as possible in the future, each observer was asked to mark his actual stopping points on his map. The maps then were returned to the Migratory Bird Populations Station so that master maps could be prepared for future use.

Figure 1 shows the starting points of the 1966 routes as selected for each State and Province by a random drawing. Only those routes that were covered and reported in time to be used in the present analysis are shown.

Observer Contacts

To facilitate the organization of the Survey and the selection of competent cooperators to run the routes, a coordinator was selected for each State. The coordinators selected were generally professional ornithologists or individuals especially active in bird work who would be in a good position to direct the activities of birders throughout the State.

Coverage

Coverage was standardized as much as possible. Each observer was instructed to start at exactly one-half hour before local sunrise, making 50 stops along a predetermined route. The stops were one-half mile apart, and the observer watched and listened for exactly three minutes at each stop.

The 1966 Survey was scheduled to be completed during June. Several areas in the north were not surveyed until early July, but satisfactory results were obtained. It was realized, and subsequently supported by this year's Survey, that routes in the southern part of the United States should be covered during late May or early June, as vocalization drops off noticeably during June.

Except for certain experimental routes, each was covered once. This report presents an analysis of data obtained on 585 routes that were successfully run in 1966.

Figure 1. Distribution of 1966 Breeding Bird Survey routes

In order to keep variability resulting from weather conditions to a minimum, observers were requested not to run their routes during rainy or foggy weather or if the wind exceeded twelve miles per hour (Beaufort 3). It takes approximately four hours to cover each route.

Recording of Data

Figure 2 is a reproduction of an actual field data sheet showing how the observations were recorded. One sheet was used for the first 10 stops, a separate sheet for the next 10, etc. Each bird seen or heard was marked by placing a tick mark in the appropriate column. All birds seen within one-quarter mile of the stop were counted, along with all birds heard, regardless of distance. The quarter-mile distance is judged as one-half the distance from the preceding stop. No effort was made to

Bureau of Sport Fisheries and Wildlife — FIELD SHEET, BREEDING BIRD SURVEY

State MD. Route Name BELTSVILLE Route No. P-1 Date 6/10/66 Page 1

Stop No.	01	2	3	4	5	6	7	8	9	10
Starting Time	5:13	17½	22	27	31½	36	41	45½	50	54½
Speedometer 033	16.4	16.9	17.4	17.9	18.5	19.0	19.5	20.0	20.5	21.0
_____ HERON										
_____ HERON										
C. GOOSE ~~Duck~~						23				
TURKEY VULTURE.....										
BLACK VULTURE.....										
_____ HAWK										
_____ HAWK										
OSPREY.....										
BOBWHITE.....						1			1	
RING-NECK PHEASANT.										
_____ RAIL										
KILLDEER.....						II				
_____ PLOVER										
WOODCOCK										
SPOTTED SANDPIPER..										
_____ SANDPIPER										
_____ GULL										
_____ TERN										
ROCK DOVE.....										
MOURNING DOVE.....		1								
YELLOW-BILL CUCKOO.										
BLACK-BILLED CUCKOO										
BARRED OWL		1								
CHUCK-WILL'S-WIDOW.										
WHIP-POOR-WILL.....										
COMMON NIGHTHAWK...										
CHIMNEY SWIFT.....										
RUBY-T HUMMINGBIRD.										
BELTED KINGFISHER..										
YELLOW-SHAFT FLICKR							1			
PILEATED WOODPECKER										
RED-BELLIED WOODP'R										
HAIRY WOODPECKER...										
DOWNY WOODPECKER...										
E. KINGBIRD.....	1		1	1				1		
GR CREST FLYCATCHER			1							
E. PHOEBE.....	1									
ACADIAN FLYCATCHER.										
TRAILL'S FLYCATCHER										
LEAST FLYCATCHER...										
E. WOOD PEWEE.....										
HORNED LARK.....										
ROUGH-WING SWALLOW.										
BARN SWALLOW.....			1							
_____ SWALLOW										
PURPLE MARTIN.....										
BLUE JAY.....							1			
COMMON CROW.....		II	1	IIII	II	1		II		
FISH CROW.....										
BLACK-CAP CHICKADEE										
CAROLINA CHICKADEE.								1		
TUFTED TITMOUSE....	1	1	1	1			1			
WHITE-BR. NUTHATCH.										
_____ NUTHATCH.										
HOUSE WREN.....										
CAROLINA WREN.....										
_____ WREN										
MOCKINGBIRD.....	I	1								1
CATBIRD.....		1			1				1	II
BROWN THRASHER.....	1							1		

Stop No.	01	2	3	4	5	6	7	8	9	10
Starting Time										
Speedometer	16.4		17.4			19.0		20.0		
ROBIN.....	III									1
WOOD THRUSH.....		II								1
HERMIT THRUSH.....										
VEERY.....										
E. BLUEBIRD.....										
BLUE-GR GNATCATCHER										
CEDAR WAXWING.....										
STARLING.....				II						1
WHITE-EYED VIREO...								1		
YELLOW-THR. VIREO..										
SOLITARY VIREO.....										
RED-EYED VIREO.....							1	1	1	1
WARBLING VIREO.....										
BLK-AND-WHT WARBLER					II					
PROTHONOTARY WARB..										
WORM-EATING WARBLER										
GOLDEN-WING WARBLER										
PARULA WARBLER.....										
YELLOW WARBLER.....										
MAGNOLIA WARBLER...										
BLK-THR. BLUE WARB.										
BLK-THR. GREEN WARB										
CERULEAN WARBLER...										
BLACKBURNIAN WARB..										
YELLOW-THRTD. WARB.										
CHESTNUT-SIDED WARB										
PINE WARBLER.....										
PRAIRIE WARBLER....										
OVENBIRD.....		1			II		1		1	
___ WATERTHRUSH....										
KENTUCKY WARBLER...										
YELLOWTHROAT.....						1		II		
YELLOW-BR. CHAT....										
HOODED WARBLER.....										
CANADA WARBLER.....										
AMERICAN REDSTART..		1								
HOUSE SPARROW.....			1							
BOBOLINK.....										
E. MEADOWLARK.....										
RED-WINGED BLACKBRD										
ORCHARD ORIOLE.....	1									
BALTIMORE ORIOLE...										
BOAT-TAILED GRACKLE										
COMMON GRACKLE.....			1					III		IIII
BROWN-HEAD COWBIRD.						1				
SCARLET TANAGER....				1						
SUMMER TANAGER.....										
CARDINAL.....		II	1							1
ROSE-BR. GROSBEAK..										
BLUE GROSBEAK.....										
INDIGO BUNTING.....										
AMERICAN GOLDFINCH.										
RUFOUS-SIDED TOWHEE		II			III	1		II	1	
SAVANNAH SPARROW...										
GRASSHOPPER SPARROW										
VESPER SPARROW.....										
CHIPPING SPARROW...	II		II							
FIELD SPARROW.....										
SWAMP SPARROW.....										
SONG SPARROW.....	II									
_____ SPARROW										

Figure 2. Field sheet for recording Breeding Bird Survey data

Bureau of Sport Fisheries and Wildlife — SUMMARY SHEET, BREEDING BIRD SURVEY

State TENN Route No. T8 Starting Locality MANSFIELD Lat.-Long. 36°10- 88°44 West

W of same; 4 mi W of Tenn 77

Counties (Stop numbers in each) Henry Co Weakley Co

Observer (Last name, then initials) COFFEY, B. B.

Mailing Address 672 N. Belvedere Memphis Tenn 38107

Weather (start & finish): Temp. 67°-73° Wind Speed, Beaufort 0-1 Sky Code 0-0

Date 6/18/66 Total Species 61 Name of Assistant, if any COFFEY, L. C.

Species	AOU	Page Totals 1	2	3	4	5	Total Indiv.	No. of Stops
Green Heron	201							
Wood Duck	144							
Turkey Vulture	325			1		1	2	2
Black Vulture	326							
Red-tailed Hawk	337					1	1	1
Red-shouldered Hawk	339							
Broad-winged Hawk	343							
Osprey	364							
Sparrow Hawk	360							
Bobwhite	289	11	15	13	5	13	57	33
Ring-neck Pheasant	309							
Killdeer	273							
Woodcock	228							
Spotted Sandpiper	263							
Willet	258							
Laughing Gull	058							
Mourning Dove	316	17	21	15	4	9	66	29
Yellow-billed Cuckoo	387	3	3	1	1	1	9	9
Black-billed Cuckoo	388							
Screech Owl	373							
Great Horned Owl	375							
Barred Owl	368							
Chuck-will's-widow	466	3					3	1
Whip-poor-will	41[illegible]	2					2	1
Common Nighthawk	420							
Chimney Swift	423		12	4	5	6	27	10
Ruby-T Hummingbird	428							
Belted Kingfisher	390							
Yellow-shaft Flicker	412	1					1	1
Pileated Woodpecker	405							
Red-bellied Woodpecker	409	2	1	2	3	2	10	8
Hairy Woodpecker	393	2					2	2
Downy Woodpecker	394	1	3	2	1	3	10	9
E. Kingbird	444	1	5	5	1	1	13	9
Gt Crest Flycatcher	452	2					2	2
E. Phoebe	456	1				1	2	2
Acadian Flycatcher	465	1					1	1
Traill's Flycatcher	466							
Least Flycatcher	467							
E. Wood Pewee	461	5			1	1	7	7
Horned Lark	474		1	1			2	2
Tree Swallow	614							
Barn Swallow	613	14	6	1	7	8	36	10
Rough-wing Swallow	617							
Bank Swallow	613							
Cliff Swallow	612							
Purple Martin	611	1					1	1
Blue Jay	477	3	5	7	5	9	29	17
Common Crow	488	9	7	7		5	28	15
Fish Crow	490							
Black-cap Chickadee	735							
Carolina Chickadee	736			1		7	8	3
Tufted Titmouse	731	2	1	3		1	7	6
White-br. Nuthatch	727							
Brown-headed Nut	729							
House Wren	721							
Carolina Wren	718		1				1	1
Long-bill Marsh Wren	725							
Mockingbird	703	4	9	12	13	11	49	33
Catbird	704		4		1		5	3
Brown Thrasher	705		1	3	1	1	6	5
Robin	761		2		1		3	2
Wood Thrush	755	4	1		1		6	6
Hermit Thrush	759							
Veery	756							
E. Bluebird	766	2	1		3	3	9	8
Blue-gr Gnatcatcher	751	3	2				5	4

Species	AOU	Page Totals 1	2	3	4	5	Total Indiv.	No. of Stops
Cedar Waxwing	619							
Loggerhead Shrike	622	1	3	2	2		8	7
Starling	493		4	4	4	1	13	5
White-eyed Vireo	631	6	3	2			11	9
Yellow-thr. Vireo	628	1				1	2	2
Solitary Vireo	629							
Red-eyed Vireo	624	3				1	4	4
Warbling Vireo	627							
Blk-and-wht Warb.	636	1					1	1
Prothonotary Warb	637							
Worm-eating Warbler	639							
Golden-wing Warb.	642							
Blue-winged Warb.	641							
Parula Warbler	648							
Yellow Warbler	652							
Magnolia Warbler	657							
B kthr Blue Warb	654							
Blk-thr. Green Warb	667							
Cerulean Warbler	658							
Blackburnian Warb.	662							
Yel.-thr. Warb.	663							
Chestnut-sided W.	659							
Pine Warbler	671							
Prairie Warbler	673	1		2			3	3
Ovenbird	674							
No. Waterthrush	675							
La. Waterthrush	676							
Kentucky Warbler	677	4					4	3
Yellowthroat	681	3	9	2	1	7	22	18
Yellow-br. Chat	683	4	3	5	1	4	17	14
Hooded Warbler	684							
Canada Warbler	686							
American Redstart	687							
House Sparrow	688		6		5		11	3
Bobolink	494							
E. Meadowlark	501	5	10	8	14	15	52	31
Red-winged Blkbrd.	498	2	2	1		4	9	8
Orchard Oriole	506		4	2	3	5	14	12
Baltimore Oriole	507							
Boat-tail Grackle	513							
Common Grackle	511	2	29	10	11	18	70	21
Brown-hd. Cowbird	495	11		3		8	22	10
Scarlet Tanager	608	1					1	1
Summer Tanager	610	6	2		1	2	11	9
Cardinal	593	7	9	18	21	25	80	38
Rose-br. Grosbeak	595							
Blue Grosbeak	597		3	2		1	6	6
Indigo Bunting	598	5	7	10	5	11	38	29
American Goldfinch	529		1				1	1
Rufous-sided Towhee	587	5	7	10	3	4	29	23
Savannah Sparrow	542							
Grasshopper Sparr.	546							
Henslow's Sparrow	547							
Sharp-tailed Sparr.	549							
Seaside Sparrow	550							
Vesper Sparrow	540							
Slate-col. Junco	56[illegible]							
Chipping Sparrow	560		1	3			4	4
Field Sparrow	563	4	4	5	3	5	21	19
Swamp Sparrow	584							
Song Sparrow	581							
Cooper's Hawk	333			1			1	1
Bewick's Wren	719		1		3	1	5	5
Lark Sparrow	552			2			2	1
Dickcissel	604	3	1		1	4	9	7
Rock Dove	3131							

Figure 3. Summary sheet for recording individual Survey routes

separate birds seen from birds heard, and birds seen in flight were combined with birds seen perched, singing, feeding, etc. Only those birds observed during the 3-minute period were entered on the field sheet. No birds seen while driving from one stop to the next were included unless they were also observed during one of the 3-minute listening periods.

At the conclusion of the 50 stops the data are transferred to a summary sheet (figure 3). The first five columns contain the totals from each of the five field sheets. The next column contains the total number of each species observed on the route. The last column shows the number of stops (out of a possible 50) at which each species was recorded.

Analysis of Data

Completed Survey sheets were submitted by the cooperators through the State coordinators or directly to the Migratory Bird Populations Station. An attempt was made to check the summary sheets for accuracy prior to processing; however, responsibility for the accuracy of the transferral of data from field sheets to summary sheets fell upon the individual cooperators. As an additional accuracy check, machine listings were provided for each cooperator with the request that all figures be rechecked.

Since the 1966 reports contained more than one-half million birds, it was essential that the data be transferred to punch cards for machine data processing. One card was prepared for each species recorded on each route; cards were punched directly from the summary sheets. Each card contains information on the route number, State, starting locality, observer, date, species, the number of individuals recorded on each of the five field sheets, the total individuals and the number of stops at which the species was recorded. Each card also contains a code for the life area within which the route was taken. Most States were subdivided into several life areas so that the variance would be computed separately for each major area within a State. The stratification was based on the map of life areas published by Aldrich (1963).

This stratification makes it possible to obtain weighted means and weighted variance, either by individual States, groups of States, or all of the eastern United States and eastern Canada combined. This, in turn, permits us to estimate the number of routes that would be needed to detect a change of a given percentage in the population of any breeding species.

Sources of Bias

Several observers expressed the concern that a single coverage of a 50-stop route would not adequately represent the bird population of their area. In Maryland and Delaware, members of the Maryland Ornithological Society and the Delmarva Ornithological Society are assisting with bias studies to determine the representativeness of a single trip, the effects of weather conditions, of date, and the bias inherent in varying ability of different observers.

Observer Bias

The observer bias is believed to be the greatest bias in the Survey, and for this reason, a special effort is being made to appraise it. Observers in Maryland and Delaware have been requested to cover a prescribed check route in addition to their regular routes. All of the check routes were covered by the same Bureau employee so that a correction factor could be computed for each species for each observer. Some of the results of these studies are discussed here.

Studies of observer bias indicate that if correction factors are used to compensate for differences in personnel, these must be computed separately for each species. A correction factor based solely upon the ratio of counts made by two observers covering the same route once each is not adequate, especially if they should run it on different days. A correction factor computed from the average of two trips over the same route by each observer is more dependable. In 1967, comparisons will be made of three coverages by Maryland and Delaware observers.

It is, of course, impossible for any observer to record all the birds that are within range of his 50 stops. In fact, it is unlikely that any observer recorded all of the birds at any of his stops. However, since the routes were picked at random, each is to a degree representative of the area in which it is located. The greater the density of routes the more adequately an area is represented. If the same route is covered ten times an average of the ten observations would, of course, come closer to being representative of the population than would a single coverage. On the other hand, ten separate samples within the same general area would be more representative of that area than would ten coverages of exactly the same route.

This can be illustrated by two examples. Figure 4 shows the results of coverage of a single Maryland route by ten observers in 1965 and again by the same ten observers in 1966. The totals each year are similar and there were an equal number of increases and decreases. The means and the 95 percent confidence limits indicated at the right of figure 4 show that there was no significant change in the population of Indigo Buntings on this route from 1965 to 1966.

Consider now the Blue Jay sightings for the same ten observers on the same Maryland route, as shown in figure 5. Nine of the ten observers recorded a decrease in Blue Jays and, as we see from the mean numbers of Blue Jays and the 95 percent confidence limits, there was a significant decrease in the Blue Jay population along this route. However, it happened that other routes in the same part of the State did not show a decrease. Neither was there a decrease for the State as a whole; so, although the decrease on this particular route was well substantiated, this intensive coverage gave a false picture of the actual change in population in that part of Maryland.

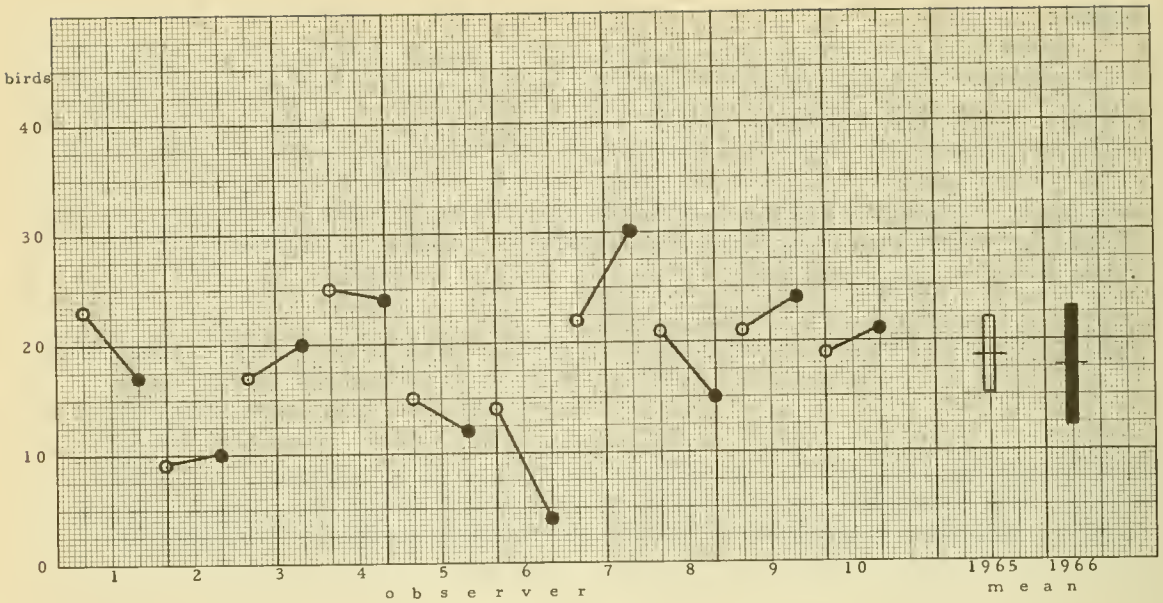

Figure 4. Comparison of Indigo Bunting population on Maryland Route P-1 as recorded by 10 observers, 1965 and 1966.

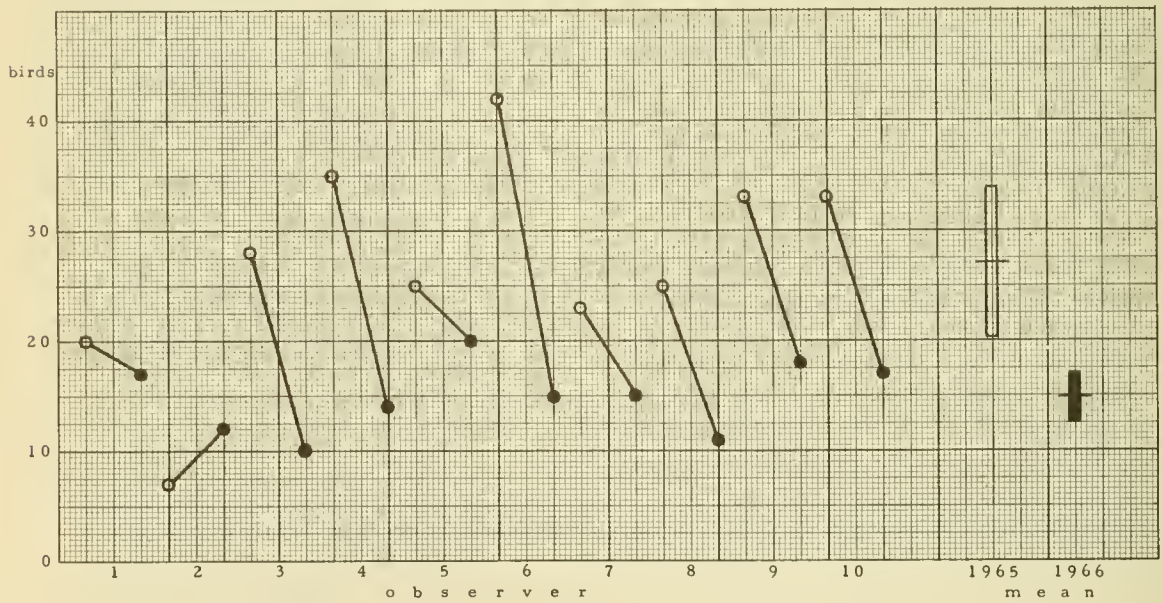

Figure 5. Comparison of Blue Jay population on Maryland Route P-1 as recorded by 10 observers, 1965 and 1966.

Seasonal Changes

For some species there may be considerable bias if counts are not taken at about the same date each season. This can be shown by an extreme example, the Downy Woodpecker. Figure 6 shows a summary of Downy Woodpecker counts obtained on 34 trips (1965-66) over the same Maryland route. These counts are combined by 10-day periods and a mean for each period is shown on the graph. The increase in numbers of woodpeckers recorded as the season progresses is quite striking, since we are sampling not only the adult population but an increasing number of young birds. Furthermore, the adults are very quiet shortly before the young leave the nest. However, for the first few weeks after the young leave the nest, both adults

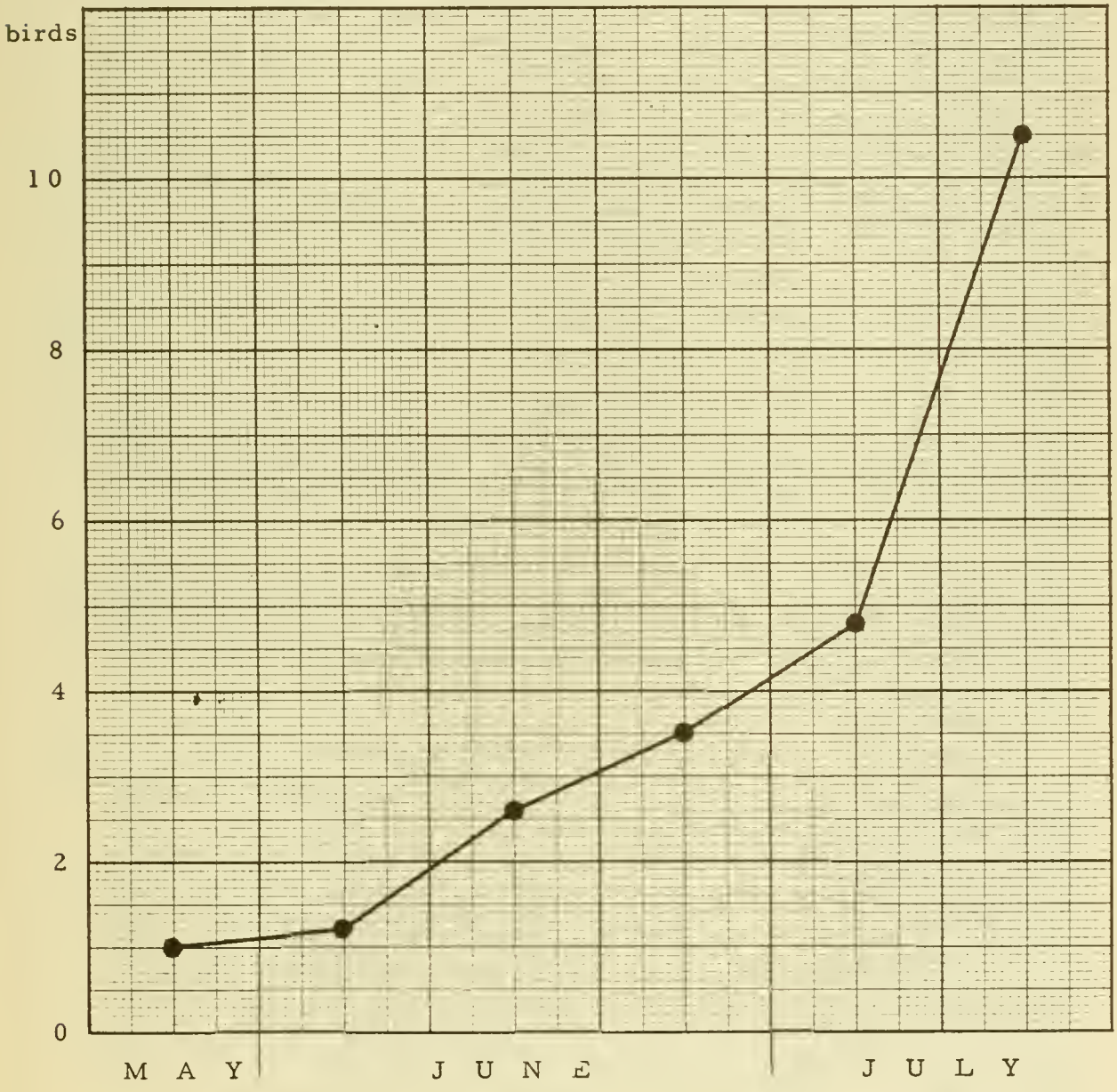

Figure 6. Seasonal change in conspicuousness of Downy Woodpeckers

and young become increasingly noisy. As long as we are aware of the bias caused by date of coverage, we can correct for this in the analysis.

Time of Day

It is a well-known fact that many species are more conspicuous in the early morning than later in the day. This matter received careful study and the recommended number of stops was determined partly on the basis of the optimum period for observing birds. It is quite obvious that species such as owls, goatsuckers, and pheasants are recorded in greatest numbers before or at dawn. Other species do not reach their peak of activity until after sunrise. There is no time of day when all species are at a peak of activity, so any observation period is of necessity a compromise if one is attempting to obtain information on all species simultaneously.

Some observers felt that 50 stops were too many and that there was a substantial decrease in singing at the last 10 stops. One of the purposes for entering the data on the punch cards by 10-stop periods was to permit easy analysis of any change in activity as the morning progressed. The graph at the top of figure 7 shows how the percentage of total birds recorded changed, from one 10-stop period to the next. Note that the observations for all species combined reached a peak in the second period and that there was a relatively slight, although steady, decline through the remaining periods.

Feeling that those birds that are detected almost entirely by sound might show a greater decline than was observed for all species combined, a separate analysis was made for the wood warbler family, Parulidae. The graph at the center of figure 7 demonstrates almost exactly the same slight decrease as shown for all species combined.

Although the average number of birds per stop would have been higher with a smaller number of stops, the total data gathered was enhanced considerably by including the full 50 stops. As long as the variability is not affected greatly by the additional stops, it seems desirable to continue with full 50-stop coverage.

In contrast to the small change in conspicuousness of wood warblers, and of all birds combined, there was a marked decline in all of the thrushes as the morning progressed. This is illustrated by the Wood Thrush data at the bottom of figure 7. As long as samples are large enough to demonstrate the normal decrease in activity as the morning progresses, this decline in conspicuousness does not in any sense invalidate the reliability of the Survey. A conspicuousness factor for each 10-stop period could be computed from figure 7 if one wished to compensate for the decrease in singing and estimate the relative numbers of birds present but not recorded. Actually, the Breeding Bird Survey does not pretend to measure the number of birds present in an area, but provides an index of abundance that can be used for detecting changes from year to year. It samples most effectively those species that are most readily seen and most frequently heard.

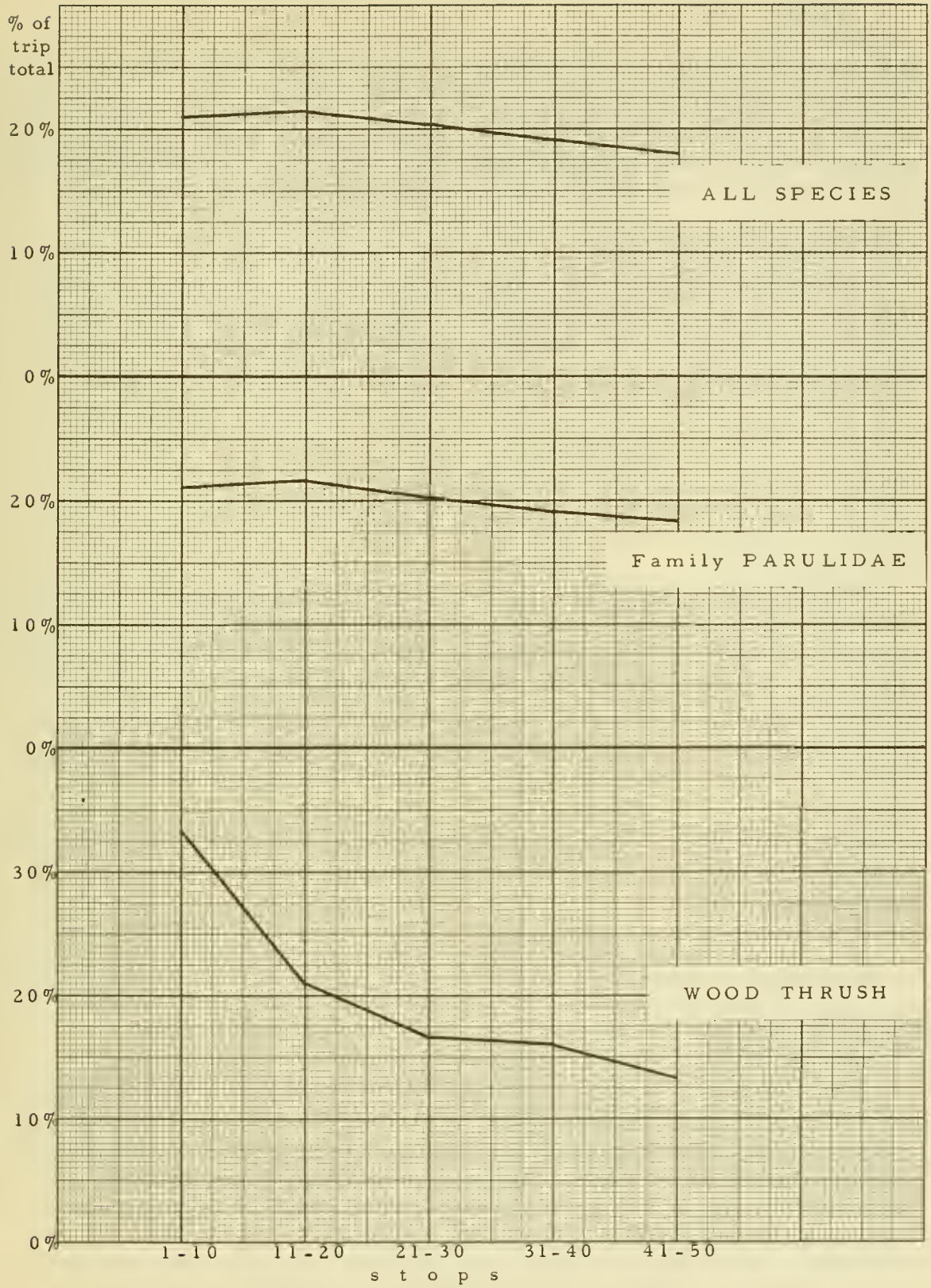

Figure 7. Effect of time of day

Weather

Study of the Survey data has shown that wind speed, temperature and cloud cover all have an effect on the number of birds recorded. By discouraging coverage on windy (over 12 m.p.h.), foggy, or rainy days, the weather bias can be kept within reasonable bounds. Even so, statistical analyses will be run to determine whether correction factors are needed to compensate for the more subtle differences in weather conditions.

Distribution of Survey Data

Duplicate copies of the individual Survey route listings were supplied to each State coordinator. In addition, various tabulations were supplied to the State coordinators and to the regional editors of Audubon Field Notes.

RESULTS

Population Status

Table 1 summarizes the totals reported for each species. It must be stressed that these figures do not represent abundance of one species in relation to other species; the species most readily observed on roadside counts will be found in greater numbers in relation to their true abundance than will inconspicuous species, species that are difficult to identify, or species found in habitats such as marsh or swampland that are not sampled by roadside observations to the same degree as is farmland.

The three figures given after each species in the table are the total individuals recorded, the percentage of routes on which the species was recorded, and the percentage of stops (of 29,250) at which each species was observed.

No species was recorded on all routes. The Red-winged Blackbird and Common Crow came closest, with one or more individuals on 99 percent of all routes. These were closely followed by the Starling (97 percent) and the Common Grackle (98 percent).

At the bottom of table 1 are a few species that were not breeding birds in the area from which they were reported. These were non-breeding stragglers or late migrants, principally shorebirds, that were observed along the routes but are not properly part of the survey. Other species that were reported in States where they do not breed are indicated by parentheses. One of the principles of random sampling is that nothing be left up to the individual judgment of observers. Consequently, it was requested that all birds identified be reported. It is quite appropriate for the observer to add notations regarding the status of any birds he does not believe to be breeding in the area sampled, but the observer

Table 1. Total individuals and frequency of detection, by species

Species	Total	Percent Routes	Percent Stops
Common Loon	36	3.25	.109
Pied-billed Grebe	26	2.22	.085
Brown Pelican	23	.68	.044
Double-cr.Cormorant	138	2.05	.123
Anhinga	20	2.05	.068
Gt. White Heron	7	.17	.023
Gt. Blue Heron	264	15.04	.670
Green Heron	429	32.48	1.220
Little Blue Heron	355	8.89	.540
Cattle Egret	1014	6.50	.724
Reddish Egret	3	.34	.010
Common Egret	750	8.03	.574
Snowy Egret	245	2.74	.112
Louisiana Heron	125	2.05	.194
Blk-cr. Night Heron	52	2.56	.085
Yellow-cr.Night Heron	32	2.39	.058
Least Bittern	7	.85	.020
Am. Bittern	44	4.10	.147
Wood Ibis	41	.68	.020
Glossy Ibis	35	1.20	.030
White Ibis	557	2.74	.229
Mute Swan	59	.34	.034
Canada Goose	25	.85	.030
Mallard	718	9.91	.297
Black Duck	123	5.81	.147
Mottled Duck	38	1.03	.044
Pintail	7	.68	.014
Green-winged Teal	12	.51	.010
Blue-winged Teal	68	3.42	.088
Am. Widgeon	1	.17	.003
Wood Duck	117	10.08	.215
Ring-necked Duck	7	.68	.014
Lesser Scaup	4	.34	.010
Common Goldeneye	7	.17	.007
Common Eider	3	.17	.003
Common Scoter	1	.17	.003
Hooded Merganser	3	.51	.010
Common Merganser	18	1.88	.044
Red-breasted Merganser	1	.17	.003
Turkey Vulture	792	28.72	1.411
Black Vulture	213	8.03	.280
Swallow-tailed Kite	14	.34	.014
Mississippi Kite	6	.86	.021
Sharp-shinned Hawk	11	1.88	.038
Cooper's Hawk	25	3.59	.079
Red-tailed Hawk	133	16.58	.420
Red-shouldered Hawk	163	10.09	.482
Broad-winged Hawk	56	7.52	.171
Rough-legged Hawk	1	.12	.003
Golden Eagle	1	.12	.003
Bald Eagle	2	.12	.007
Marsh Hawk	29	3.59	.092
Osprey	29	2.91	.096
Pigeon Hawk	1	.12	.003
Sparrow Hawk	313	24.27	.868
Spruce Grouse	1	.12	.003
Ruffed Grouse	39	4.44	.126
Bobwhite	14,623	67.01	28.789
Ring-necked Pheasant	1358	23.42	3.309
Gray Partridge	4	.34	.007
Turkey	12	1.03	.024
Sandhill Crane	12	.86	.031
Limpkin	17	.68	.048
King Rail	6	.68	.017
Clapper Rail	8	1.03	.021
Virginia Rail	6	1.03	.021
Sora	13	1.54	.038
Purple Gallinule	3	.34	.007
Common Gallinule	24	1.88	.058
American Coot	7	.68	.021
Wilson's Plover	2	.34	.007
Killdeer	1320	57.09	3.265
Am. Woodcock	21	2.22	.055
Common Snipe	171	8.21	.523
Upland Plover	155	7.69	.321
Spotted Sandpiper	83	9.06	.243
Solitary Sandpiper	2	.12	.003
Willet	81	2.56	.154
Black-necked Stilt	11	.51	.017
Wilson's Phalarope	3	.34	.010
Gt.Black-backed Gull	130	2.05	.140
Herring Gull	1308	7.01	.957
Ring-billed Gull	337	2.91	.144
Laughing Gull	990	3.42	.513
Gull-billed Tern	5	.34	.014
Forster's Tern	25	1.03	.024
Common Tern	187	3.08	.202
Arctic Tern	2	.17	.003
Least Tern	148	1.37	.129
Royal Tern	53	.86	.047
Caspian Tern	1	.17	.003
Black Tern	120	2.91	.129
Black Skimmer	13	.85	.027
White-crowned Pigeon	10	.17	.239
Rock Dove	5642	52.14	3.938
Mourning Dove	12,431	85.47	23.022
Ground Dove	251	4.96	.568
Yellow-billed Cuckoo	1801	50.60	5.241
Black-billed Cuckoo	188	16.75	.602
Barn Owl	2	.34	.007
Screech Owl	13	1.54	.034
Great Horned Owl	19	2.39	.062

Table 1. Total individuals and frequency of detection, by species (Continued)

Species	Total	Percent Routes	Percent Stops
Burrowing Owl	29	.17	.020
Barred Owl	47	6.15	.137
Chuck-will's-widow	323	15.90	.721
Whip-poor-will	209	14.36	.478
Common Nighthawk	439	15.90	.954
Chimney Swift	6432	83.93	8.793
Ruby-thr.Hummingbird	200	22.05	.612
Belted Kingfisher	290	30.94	.879
Yel-shafted Flicker	3386	91.45	9.928
Pileated Woodpecker	374	28.03	1.193
Red-bellied Woodpecker	2361	53.33	6.629
Red-headed Woodpecker	750	29.23	2.079
Yel-bellied Sapsucker	389	11.11	1.100
Hairy Woodpecker	280	28.72	.879
Downy Woodpecker	1281	67.01	3.935
Red-cockaded Woodpecker	7	.68	.014
Eastern Kingbird	2874	81.20	7.576
Gray Kingbird	22	.17	.051
Gt. Crested Flycatcher	2068	72.99	5.819
Eastern Phoebe	1347	57.78	3.993
Yel-bellied Flycatcher	54	3.42	.184
Acadian Flycatcher	755	30.06	2.130
Traill's Flycatcher	724	22.91	2.116
Least Flycatcher	1099	25.64	3.097
E. Wood Pewee	2624	78.29	7.839
Olive-sided Flycatcher	68	5.81	.232
Horned Lark	1684	36.24	3.121
Tree Swallow	1712	29.06	2.834
Bank Swallow	1806	18.63	.824
Rough-winged Swallow	560	26.50	.800
Barn Swallow	9143	82.22	12.643
Cliff Swallow	886	14.70	.827
Purple Martin	3769	56.58	4.010
Gray Jay	34	2.05	.072
Blue Jay	8762	94.53	18.851
Scrub Jay	11	.17	.270
Common Raven	359	9.40	.725
Common Crow	16,657	98.12	30.147
Fish Crow	720	12.99	1.197
Black-capped Chickadee	813	30.26	2.150
Carolina Chickadee	1655	43.42	3.614
Boreal Chickadee	56	2.91	.168
Tufted Titmouse	3583	63.42	9.781
White-br. Nuthatch	399	29.74	1.207
Red-breasted Nuthatch	34	3.93	.113
Brown-headed Nuthatch	187	8.55	.366
Brown Creeper	14	2.05	.044
House Wren	2335	52.48	6.663
Winter Wren	172	7.18	.550
Bewick's Wren	120	6.84	.359
Carolina Wren	2547	48.03	6.923
Long-billed Marsh Wren	108	3.93	.157
Short-billed Marsh Wren	150	4.62	.328
Mockingbird	10,016	59.15	21.234
Catbird	4405	82.74	11.647
Brown Thrasher	2677	81.37	7.405
Robin	20,661	87.01	36.585
Wood Thrush	5795	73.85	13.326
Hermit Thrush	462	13.68	1.279
Swainson's Thrush	567	7.86	1.415
Gray-cheeked Thrush	2	.17	.007
Veery	1552	23.93	4.048
Eastern Bluebird	2365	61.03	5.189
Blue-gray Gnatcatcher	761	33.85	2.014
Golden-crowned Kinglet	24	1.54	.051
Ruby-crowned Kinglet	548	5.98	1.590
Cedar Waxwing	1110	28.03	1.785
Loggerhead Shrike	789	25.98	2.051
Starling	48,676	95.73	29.258
White-eyed Vireo	1688	40.68	4.564
Bell's Vireo	8	.85	.024
Yellow-thr. Vireo	526	33.16	1.600
Solitary Vireo	87	6.15	.280
Blk-whiskered Vireo	14	.34	.034
Red-eyed Vireo	5697	81.20	14.721
Philadelphia Vireo	7	.51	.017
Warbling Vireo	649	28.55	1.959
Black-&-white Warbler	509	28.38	1.559
Prothonotary Warbler	171	12.14	.444
Swainson's Warbler	3	.34	.007
Worm-eating Warbler	68	6.67	.218
Golden-winged Warbler	82	4.62	.243
Blue-winged Warbler	122	8.89	.369
Tennessee Warbler	106	3.59	.325
Nashville Warbler	255	9.40	.800
Parula Warbler	470	20.85	1.299
Yellow Warbler	1893	47.86	5.562
Magnolia Warbler	537	9.40	1.419
Cape May Warbler	4	.51	.014
Blk-throated Blue Warb.	68	5.98	.202
Myrtle Warbler	149	7.35	.472
Blk-thr. Green Warbler	319	13.85	.923
Cerulean Warbler	135	8.38	.396
Blackburnian Warbler	99	7.69	.324
Yellow-thr. Warbler	161	9.57	.458
Chestnut-sided Warbler	1054	21.88	3.135
Bay-breasted Warbler	71	2.56	.225
Blackpoll Warbler	21	1.03	.062
Pine Warbler	498	20.00	1.330
Prairie Warbler	1114	29.57	2.875
Palm Warbler	4	.51	.014
Ovenbird	2086	42.91	5.624
Northern Waterthrush	113	6.67	.335
Louisiana Waterthrush	111	9.91	.331
Kentucky Warbler	473	23.93	1.432
Mourning Warbler	112	5.13	.379

Table 1. Total individuals and frequency of detection, by species (Continued)

Species	Total	Percent Routes	Percent Stops
Yellowthroat	7103	89.57	19.224
Yellow-br. Chat	4342	52.14	11.084
Hooded Warbler	310	15.90	.885
Wilson's Warbler	23	1.20	.075
Canada Warbler	184	8.03	.561
American Redstart	1252	35.56	3.607
House Sparrow	48,238	93.16	25.665
Bobolink	2563	33.50	4.715
E. Meadowlark	13,493	87.52	23.282
W. Meadowlark	1730	10.94	3.142
Yel-headed Blackbird	18	.68	.034
Red-winged Blackbird	46,612	98.12	34.397
Orchard Oriole	1702	38.80	4.455
Spotted-breasted Oriole	1	.17	.003
Baltimore Oriole	1354	48.72	3.918
Rusty Blackbird	23	2.56	.072
Brewer's Blackbird	119	2.56	.164
Boat-tailed Grackle	617	3.25	.632
Common Grackle	49,750	97.26	33.108
Brown-headed Cowbird	5852	86.32	10.940
Scarlet Tanager	1083	41.20	3.303
Summer Tanager	1097	32.65	3.214
Cardinal	12,749	77.78	27.005
Rose-breasted Grosbeak	718	24.10	2.116
Blue Grosbeak	923	25.30	2.492
Indigo Bunting	10,462	84.62	24.130
Painted Bunting	59	1.88	.150
Dickcissel	1860	19.82	3.262
Evening Grosbeak	143	2.56	.209
Purple Finch	516	18.12	1.368
House Finch	24	.51	.044
Pine Grosbeak	11	.85	.031
Pine Siskin	62	2.74	.126
Am. Goldfinch	5529	77.61	10.725
White-winged Crossbill	4	.17	.010
Rufous-sided Towhee	7478	81.37	17.340
Savannah Sparrow	2708	27.01	5.224
Grasshopper Sparrow	1793	40.51	4.301
Henslow's Sparrow	84	6.15	.215
Sharp-tailed Sparrow	35	.85	.061
Seaside Sparrow	26	1.03	.041
Vesper Sparrow	1657	33.16	4.154
Lark Sparrow	36	1.88	.072
Bachman's Sparrow	156	4.79	.321
Slate-colored Junco	615	10.77	1.720
Chipping Sparrow	6018	83.07	14.756
Clay-colored Sparrow	116	3.42	.301
Field Sparrow	7488	77.26	17.737
White-throated Sparrow	2364	17.61	5.487
Fox Sparrow	4	.17	.014
Lincoln's Sparrow	43	1.71	.133
Swamp Sparrow	258	13.85	.649
Song Sparrow	10,610	73.85	24.844

Transients and non-breeding stragglers recorded on Survey: Magnificent Frigatebird, Whistling Swan, Common Scoter, Rough-legged Hawk, Semipalmated Plover, Black-bellied Plover, Ruddy Turnstone, Greater Yellowlegs, Lesser Yellowlegs, Knot, Dunlin, Short-billed Dowitcher, Semipalmated Sandpiper, Western Sandpiper, Sanderling.

cannot be expected to separate all breeding birds from non-breeding birds; if observers were asked to do this, it certainly would not be done uniformly on all routes.

This does not mean that all birds reported are accepted as breeding records--which many certainly are not--but it does permit the uniform treatment of obvious transients, non-breeding gulls and terns, summering non-nesting shorebirds, and others.

Table 2 summarizes the average number of birds reported per route in each State and Province. The States are arranged geographically, from Mississippi and Alabama north to Wisconsin and Michigan and then from Florida north to the Provinces of New Brunswick and Quebec. This arrangement should facilitate comparison of abundance from one State or Province to another. All averages are rounded to the nearest whole number. A plus sign (+) indicates an average of less than one-half bird per 50-stop route.

Table 2. Average number of birds per 50-stop route, by States and Provinces

No. of Routes:		15	40	38	36	15	16	44	50	10	23	18	8	15	12	10	49	19	7	47	2	2	3	27	15	22	7	15	2	15	3
States:		Mis	Ala	Ten	Ky	Ill	Ind	Ohi	Wis	Mic	Fla	Ga	SC	NC	Va	Del	Md	WVa	NJ	Pa	RI	Con	Mas	NY	Vt	NH	Me	NS	PEI	NB	Que
Species	AOU																														
Common Loon	007								+	+														+			1	+	1	+	
Pied-billed Grebe	006						+		+		+														+			+		+	2
Brown Pelican	126	+									1																				
Double-cr.Cormorant	120										5																	1		+	
Anhinga	118										1	+																			
Great White Heron	192										+																				
Great Blue Heron	194	+	+		+	1	1	1	1	+	1	1	+	+	+	+	1		+	+				+		+	+	1	15	+	1
Green Heron	201	+	1	1	1	+	1	1	+	1	4	1	2	1	1	1	1	1	+	+				+	+	+	+	+			+
Little Blue Heron	200	2	2	+							7	4	1		+																
Cattle Egret	200.1		+								37	6	1	1	+	1	+														
Reddish Egret	198										+																				
Common Egret	196	+	+			1		+	+		14	18	5	+	+	2	+														
Snowy Egret	197	+									4	7	+		+		+							1							
Louisiana Heron	199		+								3	2	1																		
Black-cr.Night Heron	202			+		+		+	+		+	1					+				5			+							
Yellow-cr.Night Heron	203		+			1					+	+	+											+							
Least Bittern	191		+								+	+					+														
Am. Bittern	190								+	+					+		+		+						+	1		+		1	1
Wood Ibis	188										1	2																			
Glossy Ibis	186										+	1	+			1	+														
White Ibis	184		+								23	1	1											2							
Mute Swan	178.2																														
Canada Goose	172		+						+											+				+			1				
Mallard	132			+		+	+	1	8	+	+					1	+		1	1				5		1			13		
Black Duck	133							+	+								+		+	+			+	1	1	+	2	+		1	
Mottled Duck	134										2																				
Pintail	143								+																			+	1		
Green-winged Teal	139								+															+						1	
Blue-winged Teal	140						+	+	1											+									10	+	
Am. Widgeon	137								+																						
Wood Duck	144	+	+	+	+	+	+	1	+		1	+		+	+	+	+		1	+			+	+	1	+			4	+	
Ring-necked Duck	150								+																			+		+	
Lesser Scaup	149								+																						
Common Goldeneye	151																													+	
Common Eider	160																											+			
Hooded Merganser	131				+				+															+							
Common Merganser	129																							+	+		+	+		1	
Red-br. Merganser	130		(+)																												
Turkey Vulture	325	1	1	2	2		+	1	+	+	7	2	1	1	3	5	3	+	3	1				+							
Black Vulture	326	1	1	+	+			+			4	1	1	+	1		+														

Table 2. Average number of birds per 50-stop route, by States and Provinces (Continued)

Species	AOU	Mis	Ala	Ten	Ky	Ill	Ind	Ohi	Wis	Mic	Fla	Ga	SC	NC	Va	Del	Md	WVa	NJ	Pa	RI	Con	Mas	NY	Vt	NH	Me	NS	PEI	NB	Que
Swallow-tailed Kite	327										1																				
Mississippi Kite	329	+	+								+																				
Sharp-shinned Hawk	332				+			+										+		+					+	+					
Cooper's Hawk	333	+	+	+	+		+	+	+	+	+	+	+	+			+	+		+											
Red-tailed Hawk	337		+	+	+	1	1	+	+	+	+	+	+	+	+	1	+		+	+		1			+	+		+			
Red-shouldered Hawk	339	+	+	+	+	+	+	+	+		5	+	1	+				+		+					+	+					
Broad-winged Hawk	343		+	+			+	+	+					+	+	+	+	+	1	+	1				+	+		+			
Golden Eagle	349																								+						
Bald Eagle	352																+														
Marsh Hawk	331						+	+	+	+										+							+	+		+	1
Osprey	364										+			+		1	+											1	+		
Pigeon Hawk	357																													+	
Sparrow Hawk	360	+	+	+	1	2	1	1	+	1	+	+		+	+	+	+	+		+	3		1	1	+	+	1	+		+	1
Spruce Grouse	298																													+	
Ruffed Grouse	300								+								+		+	+			+	+	+	+	+	+		+	
Bobwhite	289	49	60	34	24	23	35	22	1	15	23	54	68	57	61	48	48	13	20	6	4	4	22	2							
Ring-necked Pheasant	309.1					8	4	4	5	16					+	1	3	+	1	6	11	2	1	3		+		+			
Gray Partridge	288.1								+																						
Turkey	310		+		+															+											
Sandhill Crane	206								+	+	+																				
Limpkin	207										1																				
King Rail	208										+																				
Clapper Rail	211		+								+	+	+	+										+							
Virginia Rail	212																+							+							
Sora	214		+						+																					+	
Purple Gallinule	218		+									+																			
Common Gallinule	219		+						+		1	+																			
Am. Coot	221		+	+							+														+		+				
Wilson's Plover	280										+																				
Killdeer	273	1	2	1	2	2	3	4	5	5	1	+		+	1	2	2	1	1	2	1	2	1	4	2	+	2			1	10
Am. Woodcock	228								+	+			+		+	+	+						+			+	1		1		
Common Snipe	230								1	+								+		+				+	+	+	1	5	7	2	1
Upland Plover	261					1	+	1	1	+							+	+		+							+				3
Spotted Sandpiper	263						+	+	+	+		+								+				1	+	+		1	1	1	1
Solitary Sandpiper	256								+															+	+						
Willet	258		+								+		+			3	+											2			
Black-necked Stilt	226										+																				
Wilson's Phalarope	224								+																						
Gt.Black-backed Gull	047																							+			+	7	8	+	
Herring Gull	051								+	2	+			(+)	1	2	+		1		36		21	15		2	22	20	40	9	
Ring-billed Gull	054							4						(+)		(9)	(+)			(+)				(+)	(+)			(1)		+	6
Laughing Gull	058										2		2	+	31	24	6		4												
Gull-billed Tern	063										+			+																	
Forster's Tern	069		+									1			+	+	+														
Common Tern	070													+	+	6	+				9		2	1			1	2	8	1	

Table 2. Average number of birds per 50-stop route, by States and Provinces (Continued)

Species	AOU	Mis	Ala	Ten	Ky	Ill	Ind	Ohi	Wis	Mic	Fla	Ga	SC	NC	Va	Del	Md	WVa	NJ	Pa	RI	Con	Mas	NY	Vt	NH	Me	NS	PEI	NB	Que
Arctic Tern	071																													+	
Least Tern	074		1	+							3					3							+	+							
Royal Tern	065										2	+	+	+	+																
Black Tern	077							+	2	1	+													+						+	1
Black Skimmer	080	+									+				+	+	+														
White-crowned Pigeon	314										+																				
Rock Dove	313.1	1	1	3	4	18	10	19	13	5	+	3	7	1	3	5	24	4	23	20	34	4	7	17	2	3	3	1	5	1	21
Mourning Dove	316	26	38	33	27	35	49	26	14	15	8	29	38	48	36	15	25	6	19	15	4	7	8	16	1	1	+				5
Ground Dove	320		1								8	1	1																		
Yellow-billed Cuckoo	387	6	9	8	8	2	3	1	+	+	2	5	8	5	5	4	3	1	+	+		1		+	+	+	1				
Black-billed Cuckoo	388			+	+	+	+	+	1	1					1	+	+	+	+	1		2		+	1	+				+	+
Barn Owl	365																		+	+											
Screech Owl	373		+	.			+	+		+	+				+		+			+											
Great Horned Owl	375		+			+		+				+	+			+	+			+				+							
Burrowing Owl	378										1																				
Barred Owl	368	+	+	+		+		+	+		1	+	+	+	+		+	+		+						+					
Chuck-will's-widow	416	2	3	1	+		+				2	2	2	1	1	+	+														
Whip-poor-will	417	+	+	1	1	+	+	+	+			+	+	+	1	1	1	1		+			+	+	+	+	+				
Common Nighthawk	420	2	1	+	+	+		+	+	+	10	1	1	1	+	1	+		+							+	+	+		+	
Chimney Swift	423	11	18	17	19	11	9	17	4	2	3	20	18	16	11	10	9	12	6	12	9	7	15	4	4	9	10	3		2	7
Ruby-thr.Hummingbird	428	+	+	1	+	+	1	+	+	+	+	1	3	1	1	+	1	1		+			+	+	+	+	+	+		+	
Belted Kingfisher	390	+	1	1	+	+	1	+	+	+	+	+	1	+	+	+	1	1		1			1	1	1	1	+	+	2	1	
Yellow-shaft.Flicker	412	5	2	3	5	8	7	5	7	5	3	4	3	7	12	3	7	10	7	8	8	13	5	10	8	5	4	3	7	3	5
Pileated Woodpecker	405	1	1	2	2		1	+	+		1	1	2	1	1		+	2		1				+	+	+	+			+	
Red-bellied Woodpecker	409	5	9	5	5	2	4	2	1	+	17	10	16	7	10	4	7	2	+	+											
Red-headed Woodpecker	406	2	2	+	1	8	6	2	2	1	2	4	2	2	+		+			+				+							
Yel-bellied Sapsucker	402					+			+	1				+						+				1	2	3	6	3		11	1
Hairy Woodpecker	393	+	+	+	+	+	1	+	1	+	+	+	+	+	+	+	+	+	1	+	1	1	1	1	2	1	2	+			+	
Downy Woodpecker	394	1	2	3	6	2	3	1	1	1	1	2	3	3	5	2	4	3	2	2		2	1	2	3	1	1	+		1	+
Red-cockaded Wdpecker	395		+								+		+	+																	
Eastern Kingbird	444	13	9	5	5	5	5	1	5	5	4	10	12	7	7	2	5	3	4	1	1	6	5	7	6	5	5	2	1	1	5
Gray Kingbird	445										1																				
Gt.Crested Flycatcher	452	2	6	2	4	1	3	2	5	3	7	6	11	9	6	3	4	2	9	1	2	1	3	2	2	2	+				3
Eastern Phoebe	456	+	2	2	3	+	1	2	2	1	+	1	+	2	3	1	2	5	1	1	2	6	2	4	11	8	3			1	3
Yel-bellied Flycatcher	463								+																	+		2	2	1	
Acadian Flycatcher	465	+	1	2	3	+	1	1			+	1	2	1	5	1	3	5	+	1											
Traill's Flycatcher	466					+	1	2	2	2							+	+	+	1				1	1	3	2	11		11	1
Least Flycatcher	467				+			+	4	3					+		1	+		2	3	8	1	5	8	10	1	3		10	9
Eastern Wood Pewee	461	1	6	6	7	2	5	4	4	2	1	6	3	7	14	3	6	10	1	2	4	6	3	2	4	3	1	2	1	2	8
Olive-sided Flycatcher	459								+	+														+		+		1	1	2	
Horned Lark	474		+	1	1	14	13	13	4	2					1	4	4	1	1	1				2					2	1	14
Tree Swallow	614				+	+	+	+	5	3	+		+			1	+		2	1		6	13	6	12	11	38	10	29	14	7
Bank Swallow	616			+	+	3	+	+	13	1						+	1		1	1		1	1	12	9	4	8	3	111	6	3
Rough-winged Swallow	617	+	4	1	1	1	1	1	1	1		1	+	1	2	1	+	2		1				1	+	+					
Barn Swallow	613	6	4	23	23	23	19	13	12	9	+	+	2	6	26	17	23	19	10	18	11	13	13	24	24	19	25	21	2	17	16

Table 2. Average number of birds per 50-stop route, by States and Provinces (Continued)

Species	AOU	Mis	Ala	Ten	Ky	Ill	Ind	Ohi	Wis	Mic	Fla	Ga	SC	NC	Va	Del	Md	WVa	NJ	Pa	RI	Con	Mas	NY	Vt	NH	Me	NS	PEI	NB	Que
Cliff Swallow	612			+				+	8	+	+				1		+			1				1	1	9	12	2		4	+
Purple Martin	611	11	20	4	4	10	7	8	8	3	7	11	15	12	4	6	7	3	14	3	3	1	+	1	+	+				2	2
Gray Jay	484																							+				+		2	
Blue Jay	477	27	32	20	14	14	10	4	12	8	22	33	32	23	17	6	11	4	27	7	17	29	36	14	12	17	13	2	1	5	1
Scrub Jay	481										+																				
Common Raven	486								1	4					1			+		+					+	+	3	6	6	10	
Common Crow	488	25	39	31	35	18	27	22	28	20	19	31	38	27	52	28	34	35	15	32	12	18	18	24	28	13	16	25	66	23	34
Fish Crow	490	+	6	+							10	3		1	1	4	2		2	+				+							
Black-c.Chickadee	735					1	+	+	2	3					1		+	1	1	2	5	5	16	4	4	8	8	1	2	2	+
Carolina Chickadee	736	2	7	5	7	1	1	2			2	4	9	6	11	3	5	2	3	+											
Boreal Chickadee	740																									+		1		3	
Tufted Titmouse	731	4	8	10	13	3	12	10	+	1	6	5	3	10	10	13	12	10	6	3		1		+							
White-br. Nuthatch	727		+	+	+	+	+	1	1	+		+		1	2		+	2	1	1	1	1	+	2	2	1	1	+		+	1
Red-br. Nuthatch	728								+	+											1			+	+	+	1	+		1	
Brown-headed Nuthatch	729	+	2								1	2	3	2	+		+														
Brown Creeper	726				+				+	+										+			+	+	+	+	+				
House Wren	721			+	1	9	5	5	9	3				+	4	3	7	4	8	10	10	9	4	9	2	3	2				1
Winter Wren	722								+	+														+	1	2	+	1		6	
Bewick's Wren	719	+		1	2	+		+	+						+			+		+										
Carolina Wren	718	4	13	7	7	1	4	1	+		16	13	27	13	4	4	3	4	+	+			+	+							
Long-billed Marsh Wren	725		+					+	+				2			1	1		1	+				+							
Short-billed Marsh Wren	724								3	+										+											
Mockingbird	703	50	48	27	15	3	4	3			46	48	48	44	36	19	30	4	26	4			1	+			1				
Catbird	704	1	2	5	7	3	5	5	8	5		3	2	5	6	6	13	13	12	13	21	30	28	17	9	12	10	2		2	3
Brown Thrasher	705	7	8	6	5	7	5	4	5	4	2	6	14	7	11	3	5	3	7	3	2	3	4	4	1	3	1				3
Robin	761	4	7	9	22	40	27	45	33	42	0	4	3	8	35	29	46	39	66	73	39	68	78	66	56	49	51	51	132	51	40
Wood Thrush	755	4	14	8	8	1	5	5	3	3	+	8	17	13	32	9	21	24	7	11	10	17	3	14	17	15	2			+	5
Hermit Thrush	759								1	3					+		+			+			1	1	3	2	9	6	4	6	+
Swainson's Thrush	758																			+		1		+	1	2	2	9	6	22	
Gray-cheeked Thrush	757																										+				
Veery	756						+	+	6	2				+			1			2	5	12	1	11	12	17	5	1		10	7
Eastern Bluebird	766	1	6	8	16	2	5	5	3	2	5	9	4	2	2	+	1	7	1	1	1	1	+	1	1	1	1				
Blue-gray Gnatcatcher	751	1	3	3	4	+	1	2	+		1	2	2	2	5	1	1	3	+	+				+	+						
Golden-cr. Kinglet	748								+															+	+	+	2	+		+	
Ruby-cr. Kinglet	749																							+		1	1	18	7	16	
Cedar Waxwing	619			+	+	+	+	1	6	6					+		+	1		2		4	3	5	5	5	7	1		7	5
Loggerhead Shrike	622	4	4	3	1	1	+	+		+	6	3	8	6	1		+														+
Starling	493	16	25	47	71	102	111	154	42	74	2	37	52	48	254	76	116	53	130	128	45	96	226	191	54	54	153	32	68	32	217
White-eyed Vireo	631	5	9	6	6	+	2	1			10	6	5	3	3	3	3	5	1	+				+							
Bell's Vireo	633					+																									
Yellow-throated Vireo	628	+	1	1	3	+	2	1	1	+	1	1	+	1	4	+	1	2	1	+	2	1		1	+	+					+
Solitary Vireo	629			+	+				+								+	+		+				+	+	1	+	1		+	
Blk-whiskered Vireo	623										1																				
Red-eyed Vireo	624	+	7	7	7	+	3	4	9	10	2	5	6	12	28	9	14	22	3	12	21	16	7	13	17	25	6	10	1	13	5
Philadelphia Vireo	626																								+						

Table 2. Average number of birds per 50-stop route, by States and Provinces (Continued)

Species	AOU	Mis	Ala	Ten	Ky	Ill	Ind	Ohi	Wis	Mic	Fla	Ga	SC	NC	Va	Del	Md	WVa	NJ	Pa	RI	Con	Mas	NY	Vt	NH	Me	NS	PEI	NB	Que
Warbling Vireo	627			+	1	1	2	2	5	2					+		+	2	+	+		1	+	1	1	1				+	5
Black-&-white Warbler	636	1	1	1	1			+	+	1		+	+		2	2	1	2	2	1	4	3	2	1		4	2	2		3	1
Prothonotary Warbler	637	1	1	1	+	+					+	1	+	2	1	1	+	+													
Swainson's Warbler	638	+																+													
Worm-eating Warbler	639		+	+	+										+	+	+	1		+				+							
Golden-winged Warbler	642			+					1								+	+		+				+		+					
Blue-winged Warbler	641		+	+	+		+	1	+								+	+	2	+	1	4		+							
Tennessee Warbler	647									+															+	+		2		5	
Nashville Warbler	645								1	1													+	+	+	2	2	2		7	
Parula Warbler	648	1	+	1	1				+	+	2	1	6	2	2		1	2		+				+	+	1	2	2		4	
Yellow Warbler	652		+	2	2	+	1	4	6	3	+	+		+	1	1	1	8	1	4	2	1	7	7	12	5	5	12	5	5	7
Magnolia Warbler	657								+								+			+				2	+	2	2	13		15	
Cape May Warbler	650																											+		+	
Black-thr.Blue Warbler	654			+	+										+		+	+	+	+		1		1	+	1	1	+		1	
Myrtle Warbler	655								+	1										+				1	+	1	1	3		3	
Blk-thr.Green Warbler	667		+	+	+				1	+				+	+		+	1	+	+	2	1		+	1	2	3	4		4	
Cerulean Warbler	658			+	1		+	1							1		+	1		+											
Blackburnian Warbler	662								+	+							+	+		+	1		+	+	+	1		+		1	+
Yellow-thr. Warbler	663		1	1	1		+	+			+	1	1	2	1		+	+													
Chestnut-sided Warbler	659			+				+	2	1							+	+	+	2	3	8	3	5	+	13	5	8		4	2
Bay-breasted Warbler	660																									+	1	+		4	
Blackpoll Warbler	661								+																			+		1	
Pine Warbler	671	+	2	+	1				+		4	3	1	5	3	2	1	+	2		2		6	+		+					
Prairie Warbler	673	+	5	3	3		1	1			+	6	4	4	6	1	2	4	8	+	5		7	+		+					
Palm Warbler	672																											+			
Ovenbird	674		+	1	2		+	+	8	9		+		+	6	3	3	2	3	3	8	9	4	7	9	14	8	3		13	5
Northern Waterthrush	675								+	1								+		+				+	+	2	1	+		3	+
Louisiana Waterthrush	676	+	+	1	+		+	+					+	+	+	+	+	1		+				+		+					
Kentucky Warbler	677	+	1	2	2		1	1				1	+	+	2	1	1	4		+											
Mourning Warbler	679								1	+										+				+		+		2		1	1
Yellowthroat	681	7	8	13	17	8	11	8	16	7	12	8	8	13	10	11	9	17	10	8	8	17	24	16	14	19	15	20	9	21	9
Yellow-br. Chat	683	7	21	19	25	1	8	7		+	+	12	6	5	12	5	6	18	+	3				+							
Hooded Warbler	684		1	1	1			+			+	1	1	3	3	+	+	2	+	+											
Wilson's Warbler	685																									1		1			
Canada Warbler	686				+				+								+			+	1	1		1	+	4	1	1		2	
Am. Redstart	687	+	1	1	1	+	+	+	1	1					1	1	1	1	+	2	3	8	3	3	5	10	4	10	2	15	2
House Sparrow	688.2	26	43	35	78	297	282	213	91	98	15	34	48	61	64	93	104	52	67	90	22	38	53	71	11	9	8	15	17	13	74
Bobolink	494		+			3	6	6	18	11									3	3	1	1	2	5	15	8	7	9	3	8	63
E. Meadowlark	501	37	27	41	53	39	36	34	17	14	36	28	35	21	26	6	16	18	7	14	1	4	3	17	4	3	3			+	16
W. Meadowlark	501.1					7	2	+	31	2																					
Yellow-hd.Blackbird	497								+																						
Red-winged Blackbird	498	48	35	27	43	111	229	247	120	118	48	43	42	8	70	39	71	50	31	84	41	80	51	129	62	20	34	7	28	21	117
Orchard Oriole	506	8	12	7	8	1	1	+	+		2	7	14	4	2	1	2	1	+	+											
Spotted-br. Oriole	503.2										+																				
Baltimore Oriole	507	1	+	+	1	2	1	2	7	2					1	1	2	2	3	5	6	17	13	4	6	4	1			+	7

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Species	AOU	Mis	Ala	Ten	Ky	Ill	Ind	Ohi	Wis	Mic	Fla	Ga	SC	NC	Va	Del	Md	WVa	NJ	Pa	RI	Con	Mas	NY	Vt	NH	Me	NS	PEI	NB	Que
Rusty Blackbird	509																									+	+	+	1	1	
Brewer's Blackbird	510								2																						
Boat-tailed Grackle	513		+								22	2	1	+		5															
Common Grackle	511	69	42	84	118	119	82	76	38	67	29	49	127	50	393	137	177	63	104	139	42	45	104	63	19	10	25	11	221	21	78
Brown-headed Cowbird	495	4	6	9	14	7	21	12	22	16	+	3	1	2	9	5	12	10		11	4	8	4	12	9	6	7	2	4	14	12
Scarlet Tanager	608		+	1	1	+	1	1	2	1				+	5	2	4	5	1	4	7	7	2	4	4	3	+				1
Summer Tanager	610	3	6	5	4	+	1	1			3	7	10	4	2	+	1	3		+											
Cardinal	593	30	52	40	33	17	24	14	4	6	42	39	67	40	42	21	29	25	7	10	1	1		4	+	+					
Rose-br. Grosbeak	595			+	+	1	+	+	7	3					+		+	+	+	2	1	5		3	2	3	3	1		2	1
Blue Grosbeak	597	2	7	1	+	+					1	9	10	5	2	5	3		+												
Indigo Bunting	598	7	28	42	51	17	36	13	9	7	3	19	19	18	32	13	22	34	4	11	2	2	2	5	4	2	1			+	+
Painted Bunting	601	+										+	4	+																	
Dickcissel	604	4	+	3	5	41	16	1	12	+							+	+													
Evening Grosbeak	514									+															+	+	1	+		8	
Purple Finch	517								1	1										+	2	2	1	3	3	5	11	2	2	8	
House Finch	519																							1							
Pine Grosbeak	515																											+		1	
Pine Siskin	533								+	+																+	+	1		2	
American Goldfinch	529	+	1	4	13	6	15	13	12	14		1		1	18	5	8	21	5	13	6	2	2	21	16	12	15	8	4	11	20
White-winged Crossbill	522																													+	
Eastern Towhee	587	7	28	10	11	1	3	5	3	2	29	33	23	21	33	10	14	16	32	11	25	26	49	13	4	16	4				
Savannah Sparrow	542				+	1	6	4	27	14					+		+	+		1	1			11	1	1	2	11	40	12	42
Grasshopper Sparrow	546		+	1	7	6	11	7	3	2		3	1	1	6	2	8	5		2			1	1	+						
Henslow's Sparrow	547						1	+	1	1							+	+		+				+	+						
Sharp-tailed Sparrow	549															1	+											+	13		
Seaside Sparrow	550		+													+	+							+							
Vesper Sparrow	540					4	13	7	12	11				+	1	1	2	1		2			+	2		+	1			1	4
Lark Sparrow	552			+	+	1																									
Bachman's Sparrow	575		+		+			+			5	+	1	+																	
Slate-colored Junco	567																			+				1	1	2	3	15	11	16	
Chipping Sparrow	560	1	5	9	9	1	5	7	7	8		5	7	12	25	22	22	19	12	15	10	22	20	18	10	10	9	4	7	7	9
Clay-colored Sparrow	561								2	+																					
Field Sparrow	563	3	12	21	32	14	26	16	9	9	+	18	12	13	23	9	16	12	10	11	2	7	3	8	4	3	1				
White-thr. Sparrow	558								1	3										+		1	1	5	15	17	19	31	54	53	10
Fox Sparrow	585																													+	
Lincoln's Sparrow	583																							+	2	+	+	2		+	
Swamp Sparrow	584						+	+	1	+				+						+	1		1	1	1	2	1	2		2	1
Song Sparrow	581			3	12	15	40	36	28	33				3	7	10	11	24	11	23	18	34	22	42	29	18	25	35	82	27	27

Population Trends

Twenty-eight Maryland routes were covered by the same observers in both 1965 and 1966. Figure 8 shows the mean population index and fiducial limits (95 percent confidence interval) for five species. There was no change from 1965 to 1966 in populations of the Carolina Wren or the Yellowthroat. A decline is suggested for the Eastern Bluebird and the Song Sparrow, but the number of comparable routes is too small to demonstrate that the decline was statistically significant. There was, however, a significant increase in Downy Woodpeckers, and we hasten to point out that this increase was not a result of the date bias discussed on page 9. The mean date of coverage of these routes in 1966 was just one day later than in 1965.

The principal objective of the Breeding Bird Survey is to measure changes on a regional or continental scale. By feeding the raw data, plus the necessary weighting factors, into an electronic computer such as the UNIVAC 1004 we can, within seconds, obtain weighted means and weighted variance; and from this we can predict the minimum population change that can be detected if a given number of routes are surveyed in two consecutive years.

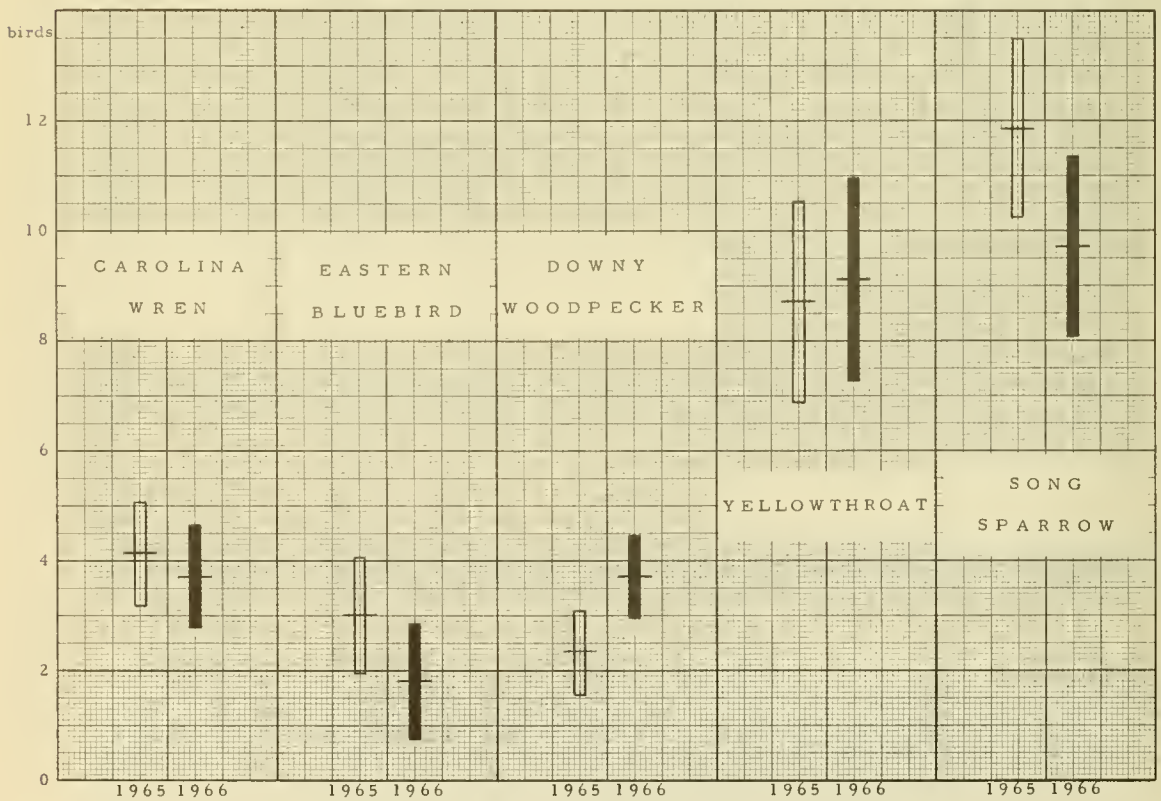

Figure 8. Maryland population indices for 5 species, 1965-1966

If, for example, the same 585 routes are run again in 1967, we would be able to detect a change of 10 percent or greater in populations of the Blue Jay, Catbird, Robin, Yellowthroat, or Indigo Bunting. There is a little more variability between routes for species such as the Mourning Dove, Yellow-shafted Flicker, Cardinal, Chipping Sparrow, and Song Sparrow, but the 1966 data suggest that a change of 12 percent could be detected in any of these. For most species, a change of between 10 and 20 percent could be detected.

On a State or Provincial basis where there are 40 or 50 routes per State, few changes in population could be documented unless the change exceeded 30 or 40 percent. However, by combining several adjacent States or Provinces, much smaller changes could be detected.

Mapping of Relative Abundance

One advantage of an electronic computer is that totals for a given species can be plotted directly on maps in such a way that relative abundance can be shown without going through the tedious procedure of locating hundreds of positions on maps and indicating the relative abundance in each of these positions. Figure 9 shows a sample map that was prepared by the UNIVAC 1004 and Figures 10 through 21 show how appropriate shading can be applied by hand onto a map that has been machine printed with the field data. This is the first time that it has been possible to map relative abundance of breeding songbirds throughout a large portion of their range.

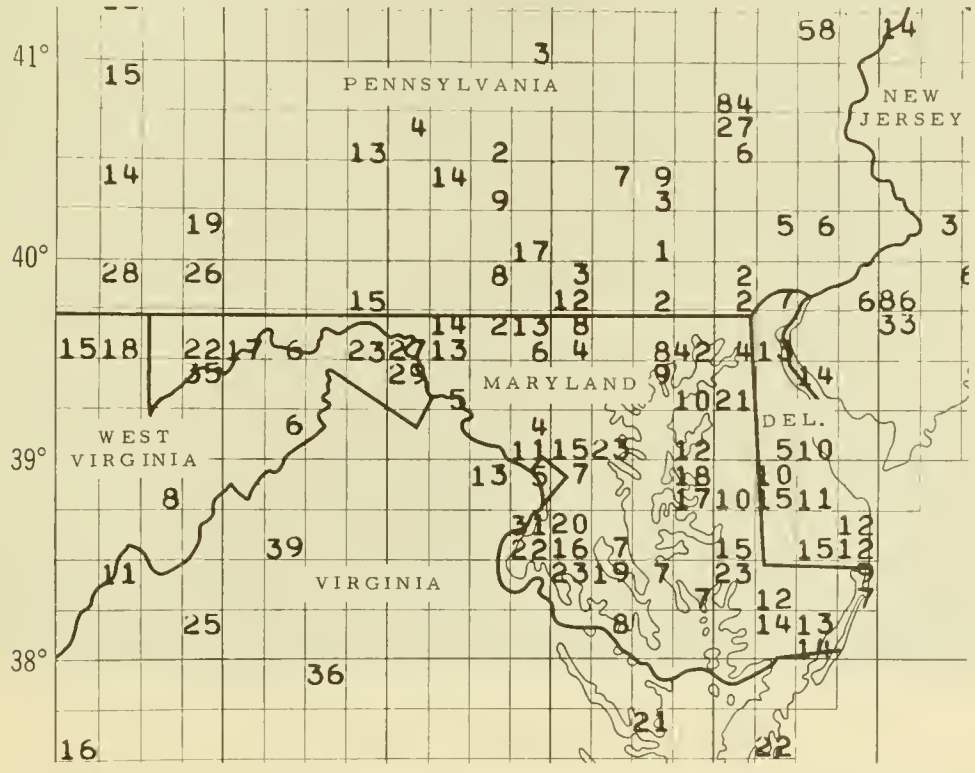

Figure 9. Portion of Rufous-sided Towhee distribution and abundance map prepared by UNIVAC 1004. All numbers on this map are less than 100.

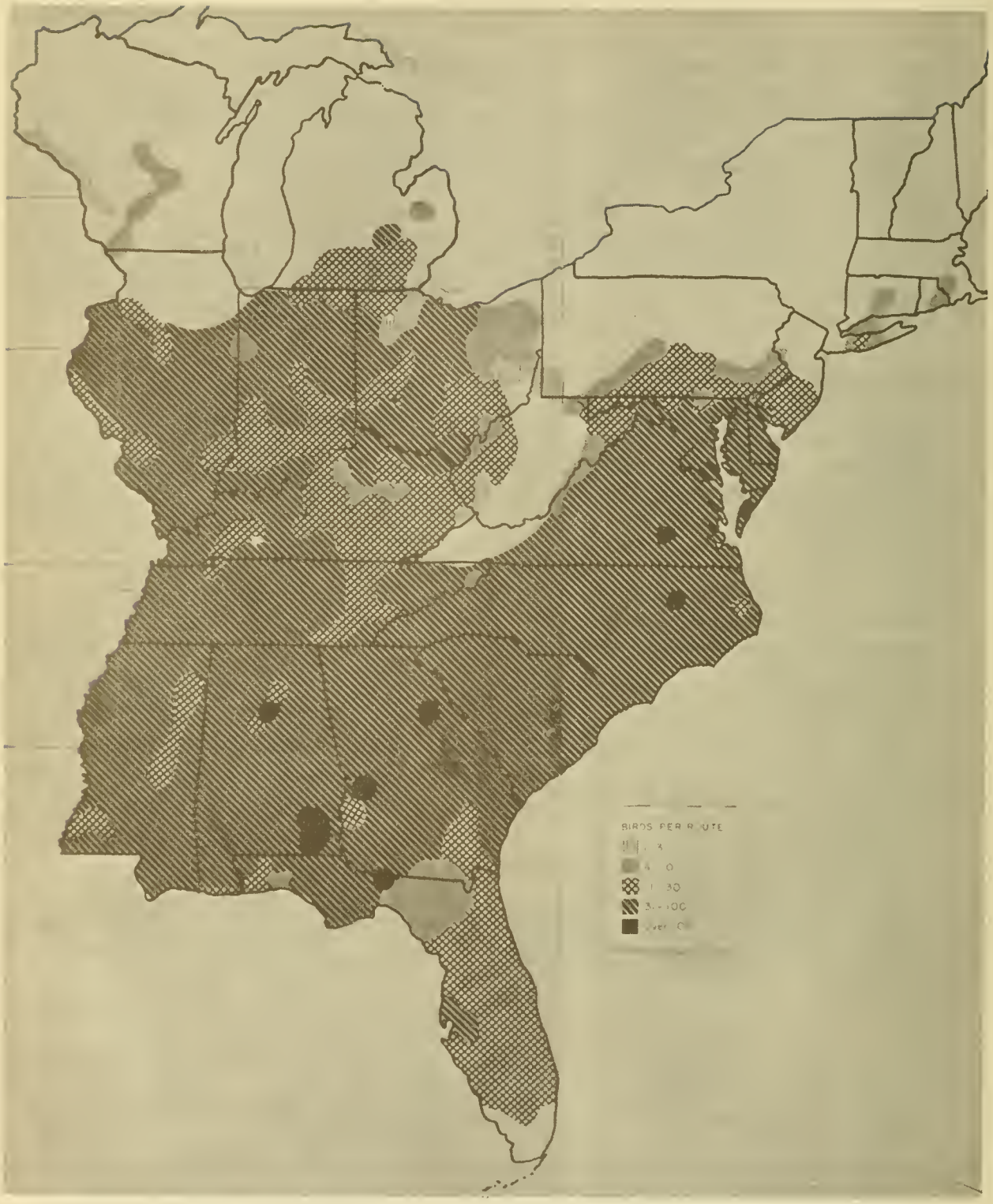

Figure 10. Bobwhite distribution, 1966

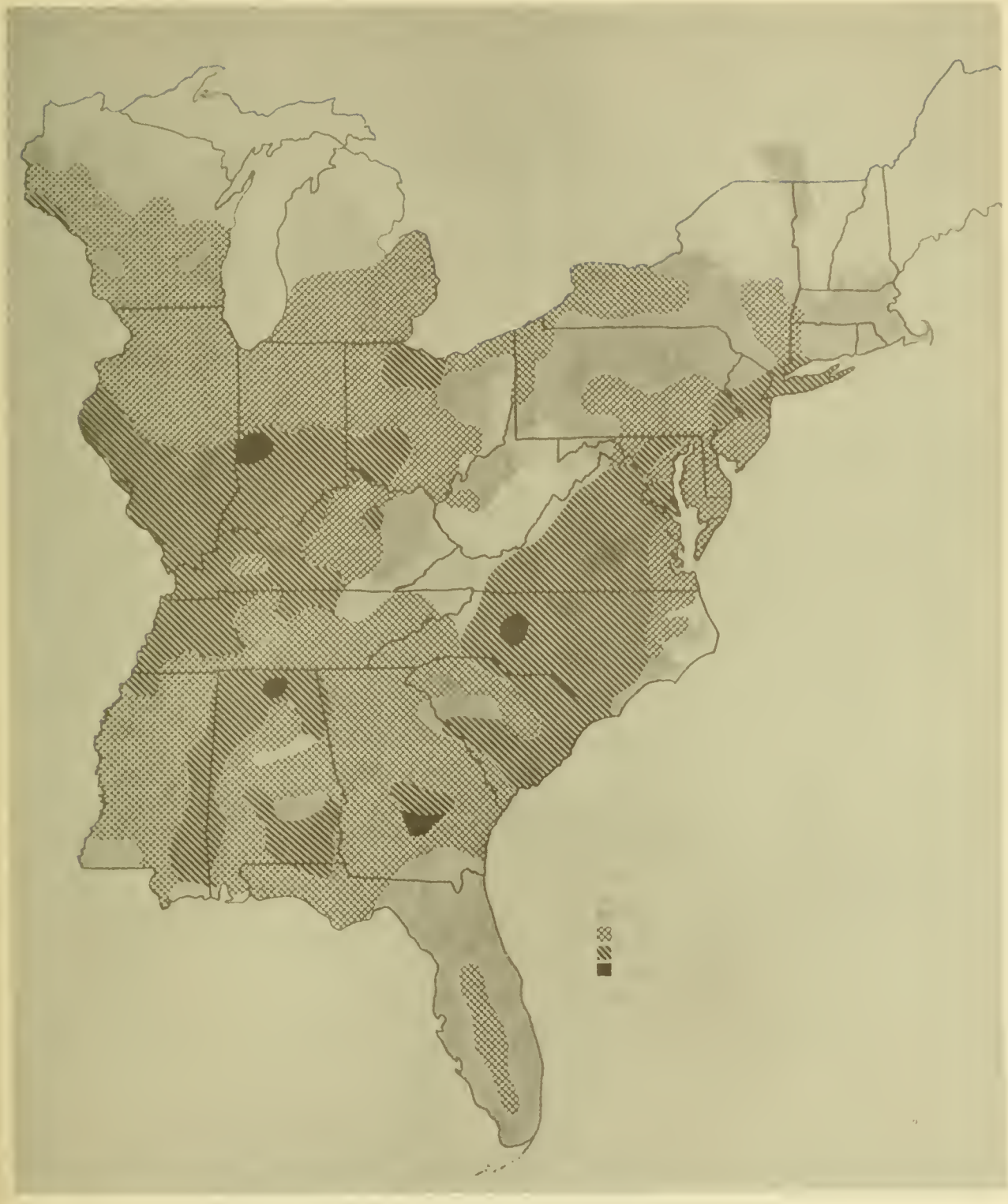

Figure 11. Mourning Dove distribution, 1966

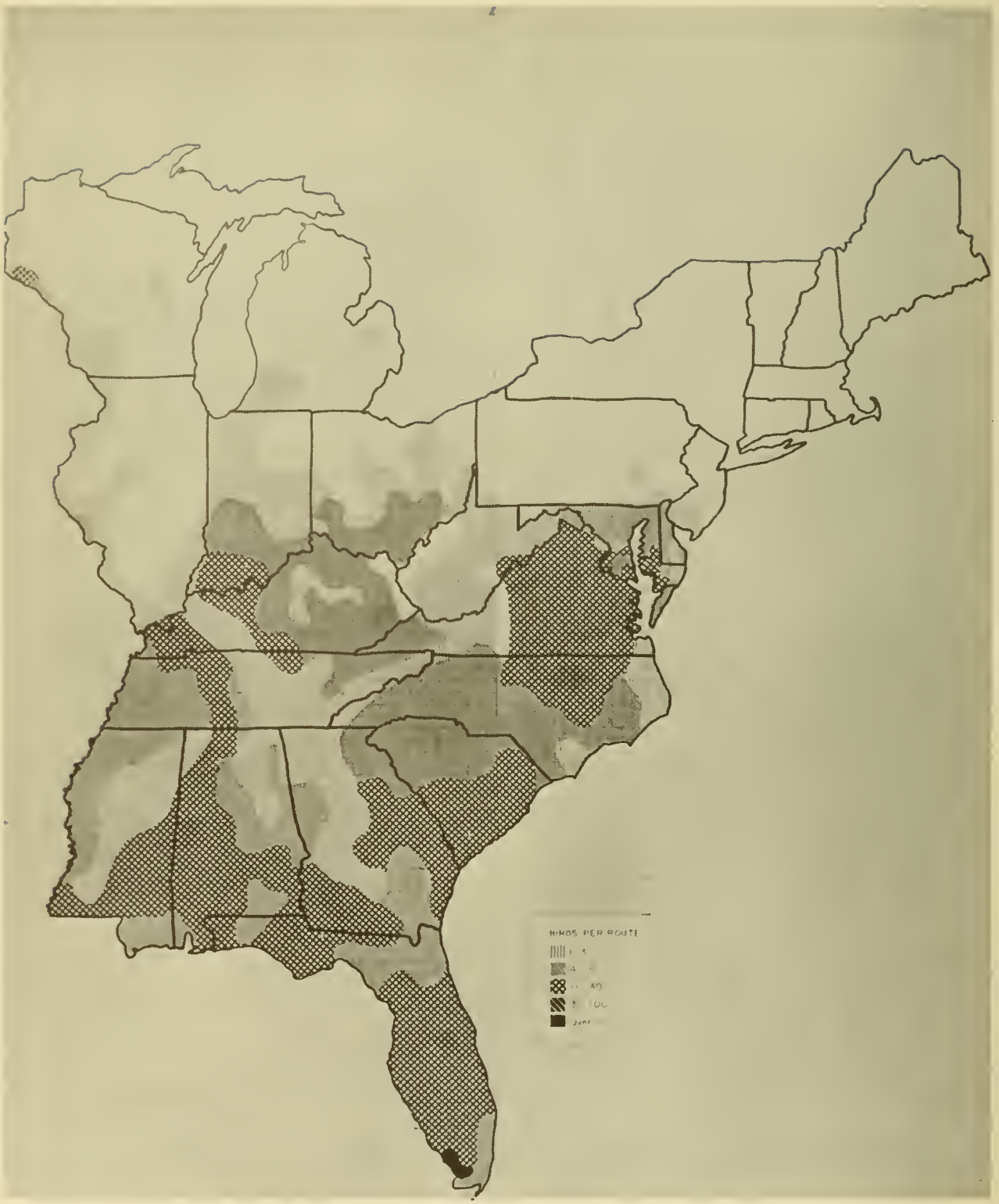

Figure 12. Red-bellied Woodpecker distribution, 1966

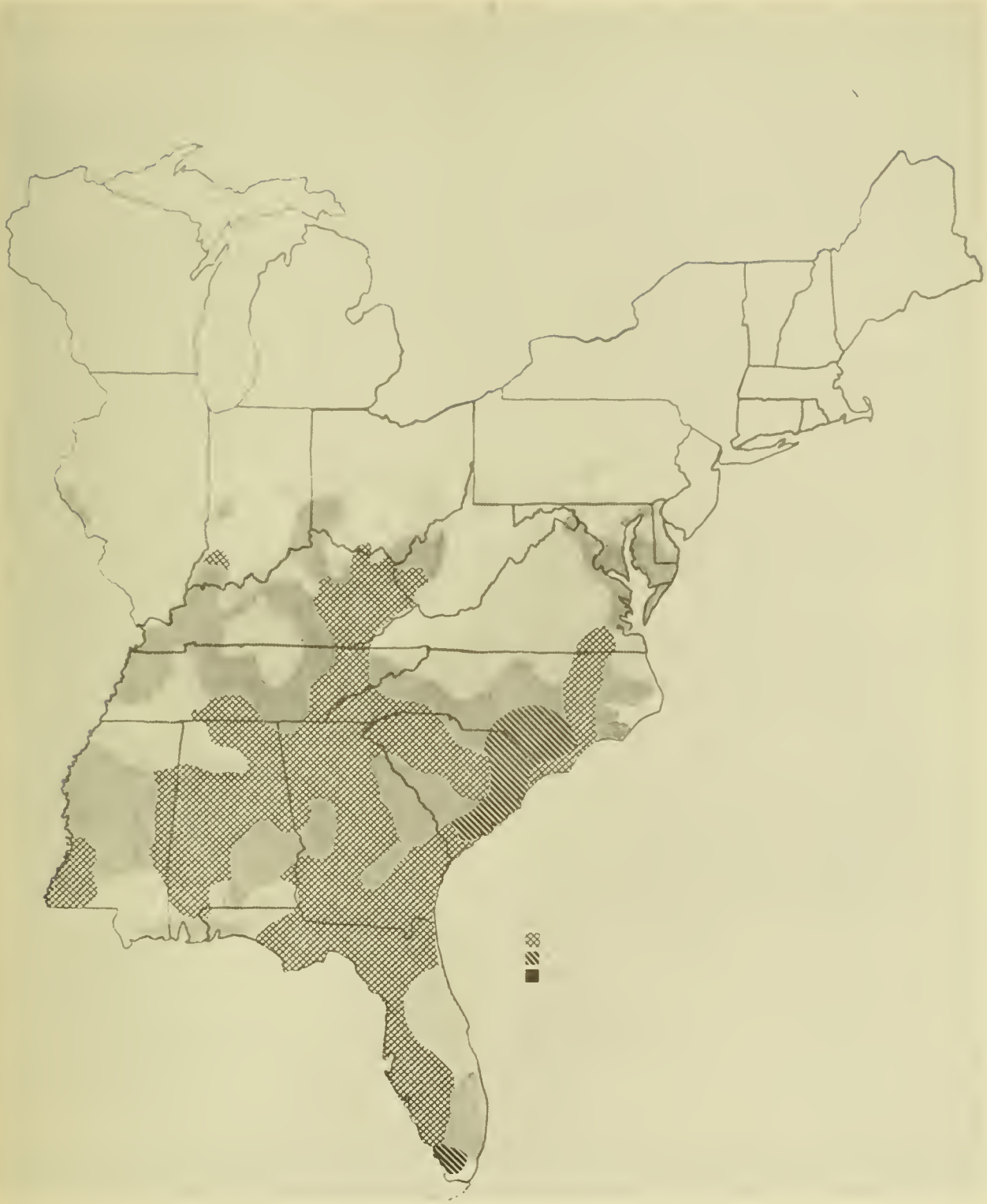

Figure 13. Carolina Wren distribution, 1966

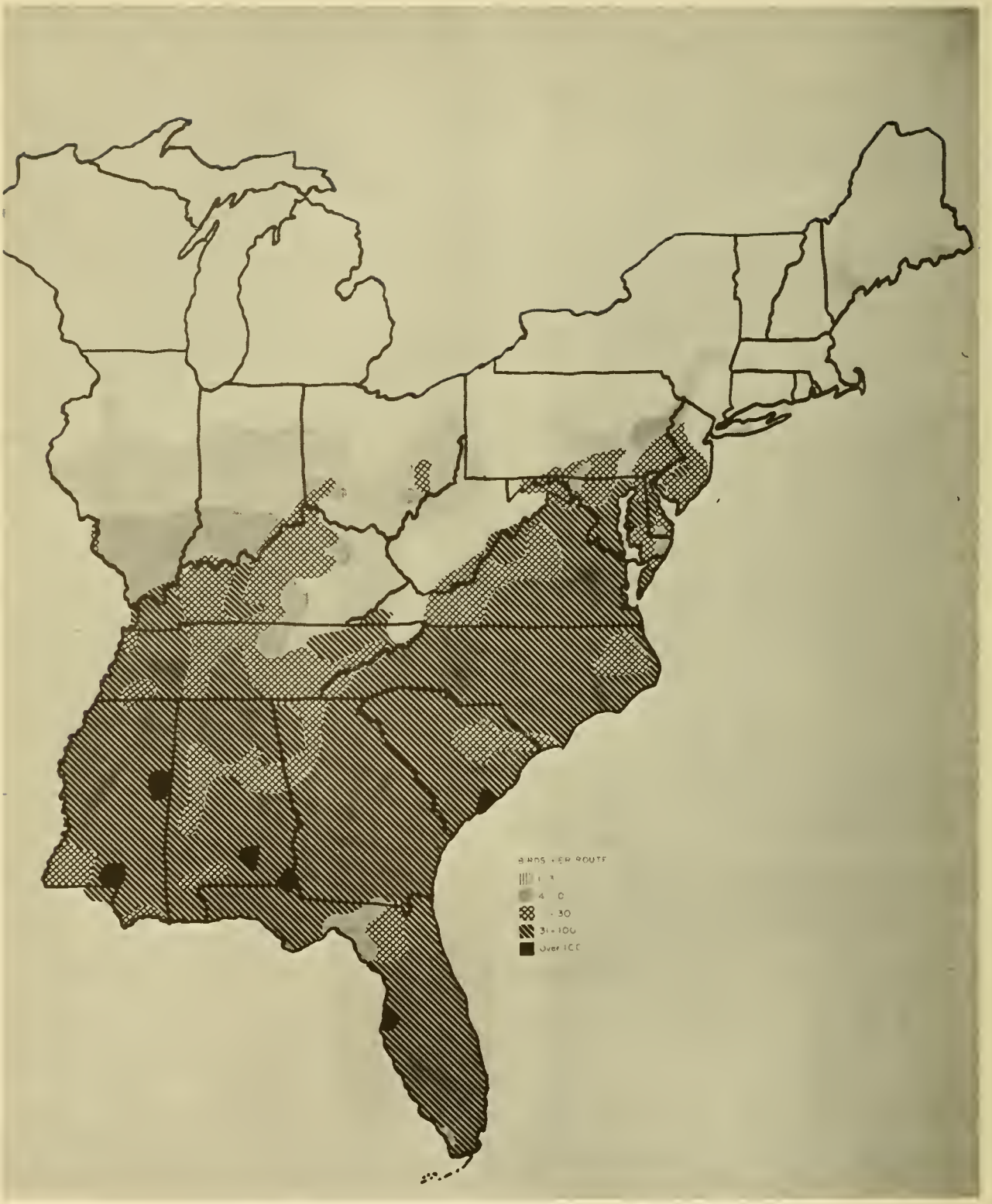

Figure 14. Mockingbird distribution, 1966

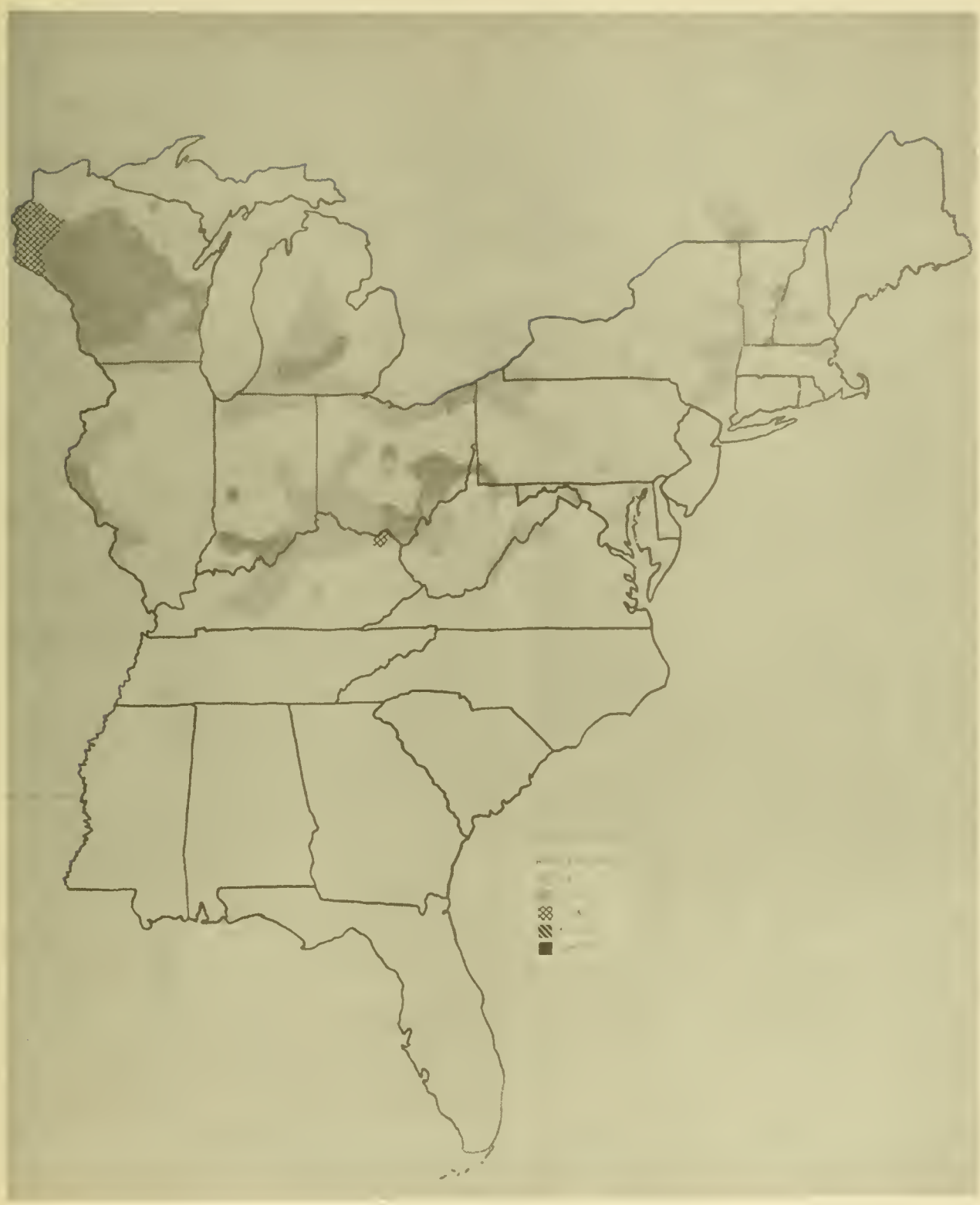

Figure 15. Warbling Vireo distribution, 1966

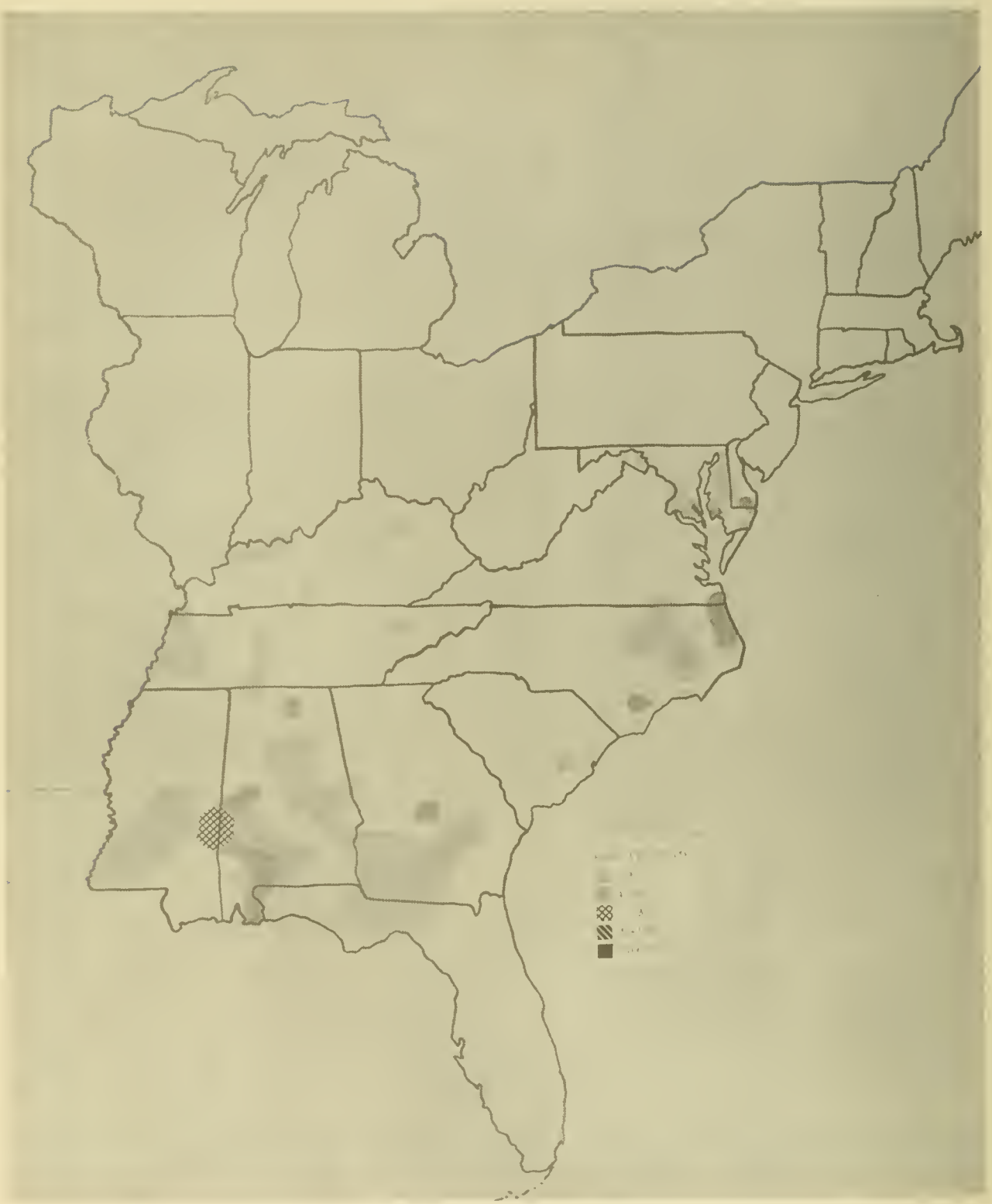

Figure 16. Prothonotary Warbler distribution, 1966

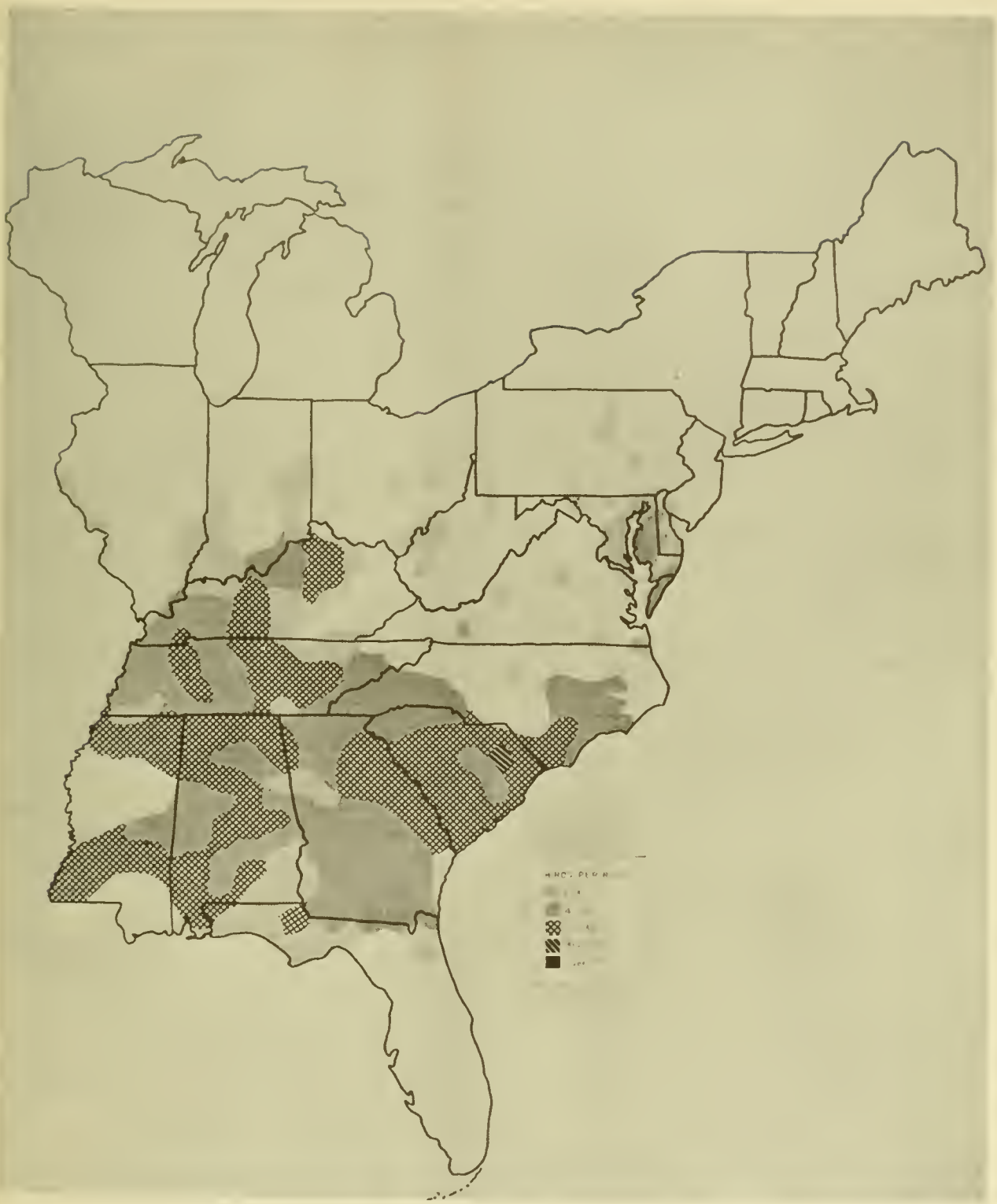

Figure 17. Orchard Oriole distribution, 1966

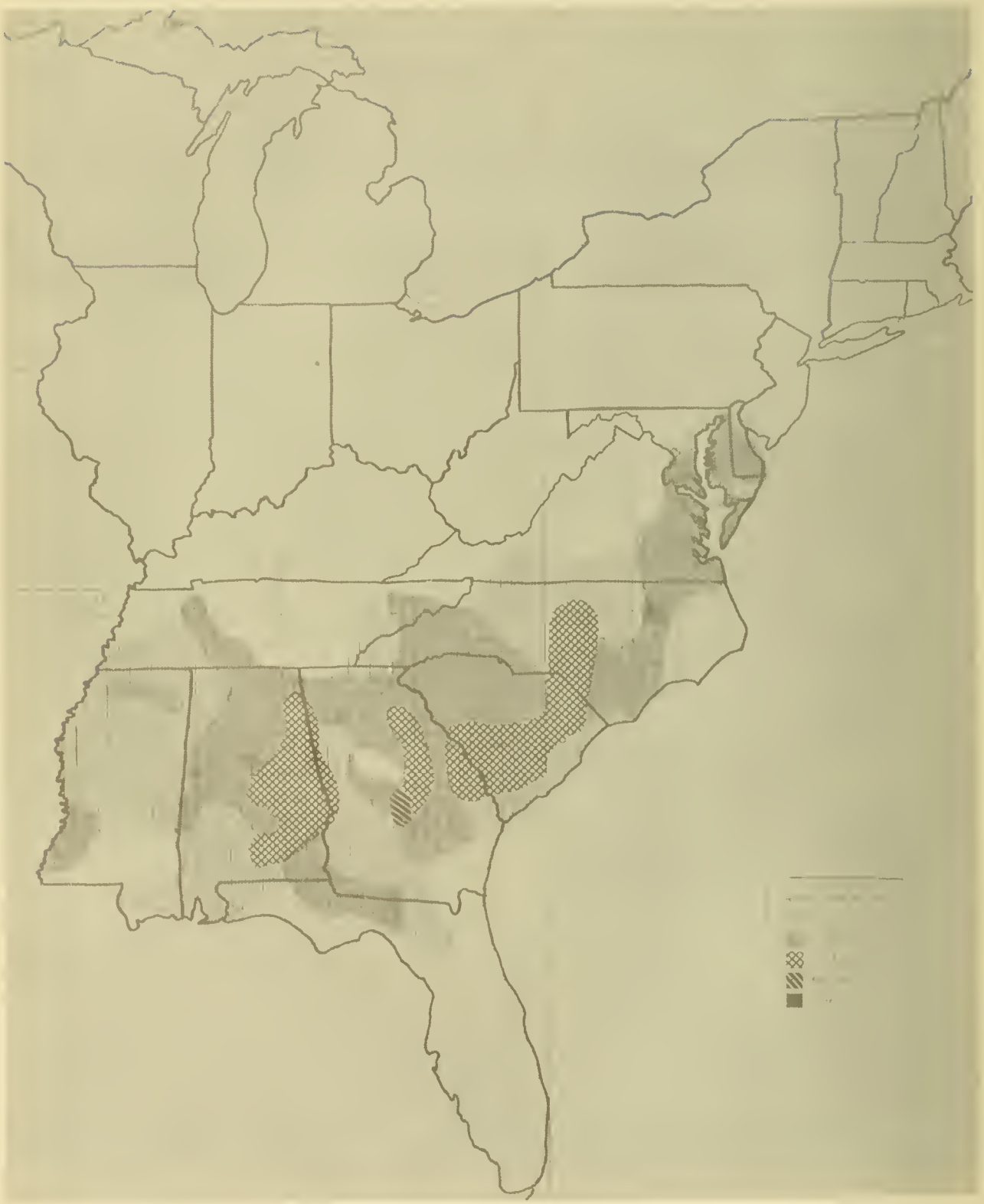

Figure 18. Blue Grosbeak distribution, 1966

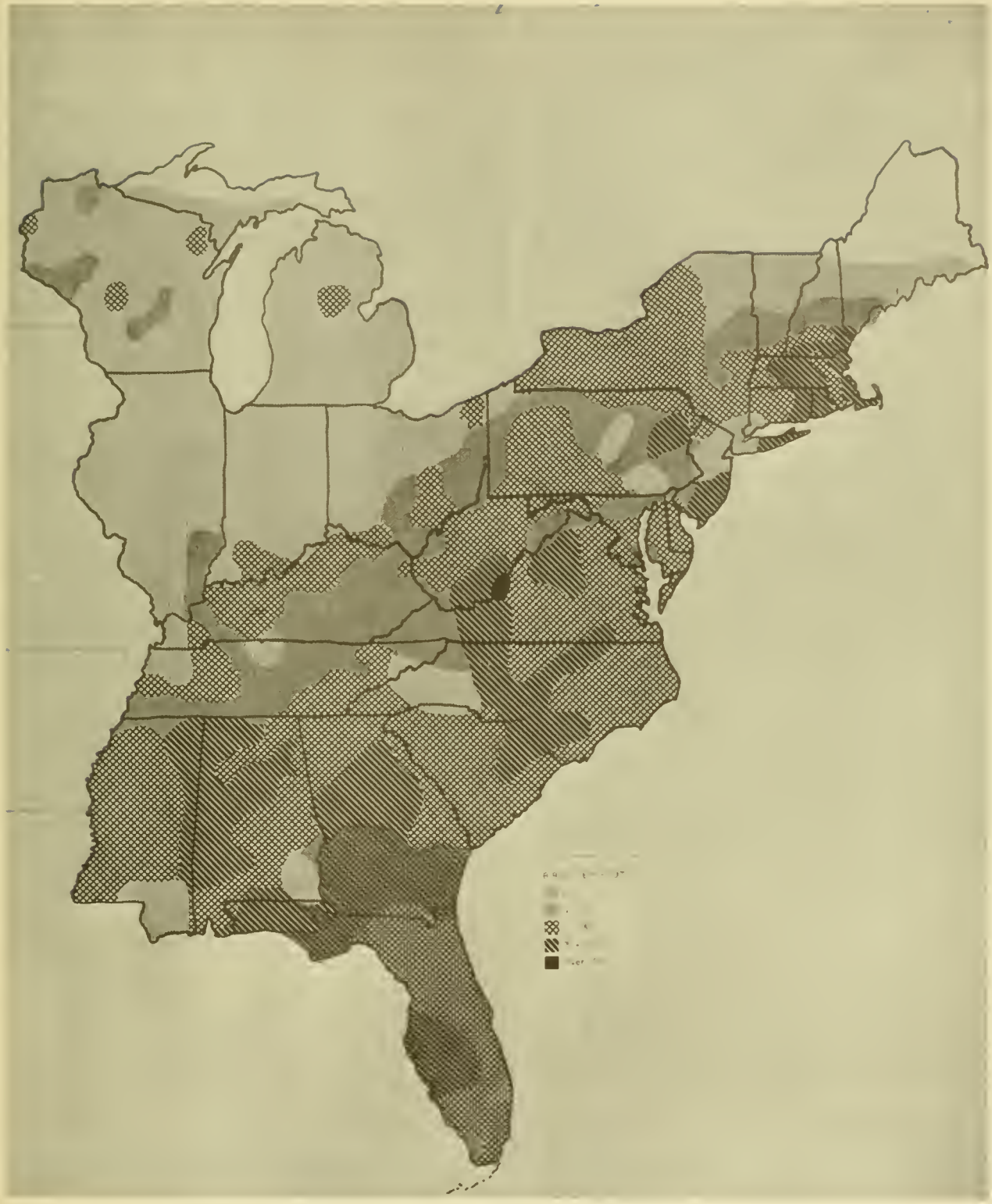

Figure 19. Rufous-sided Towhee distribution, 1966

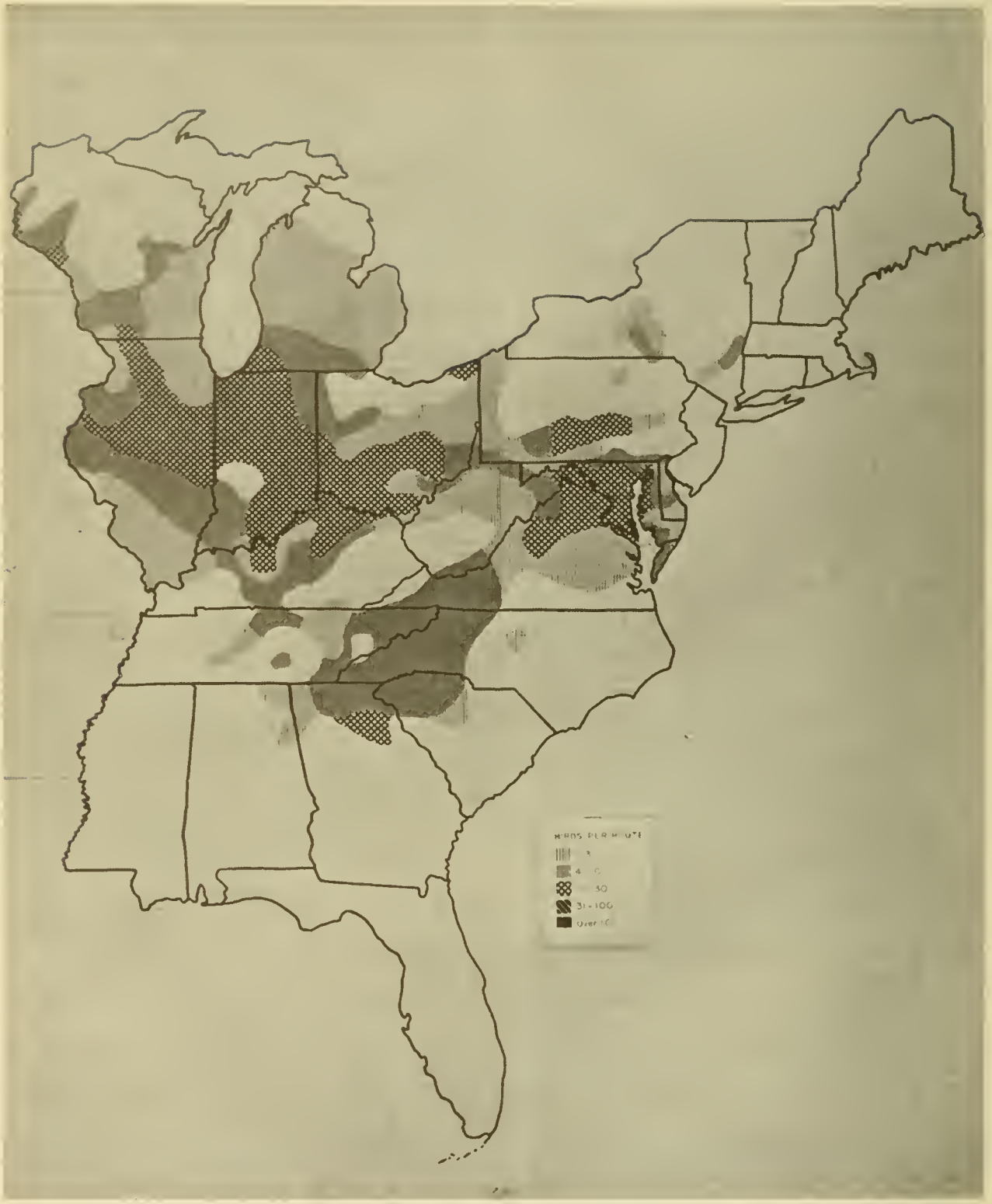

Figure 20. Grasshopper Sparrow distribution, 1966

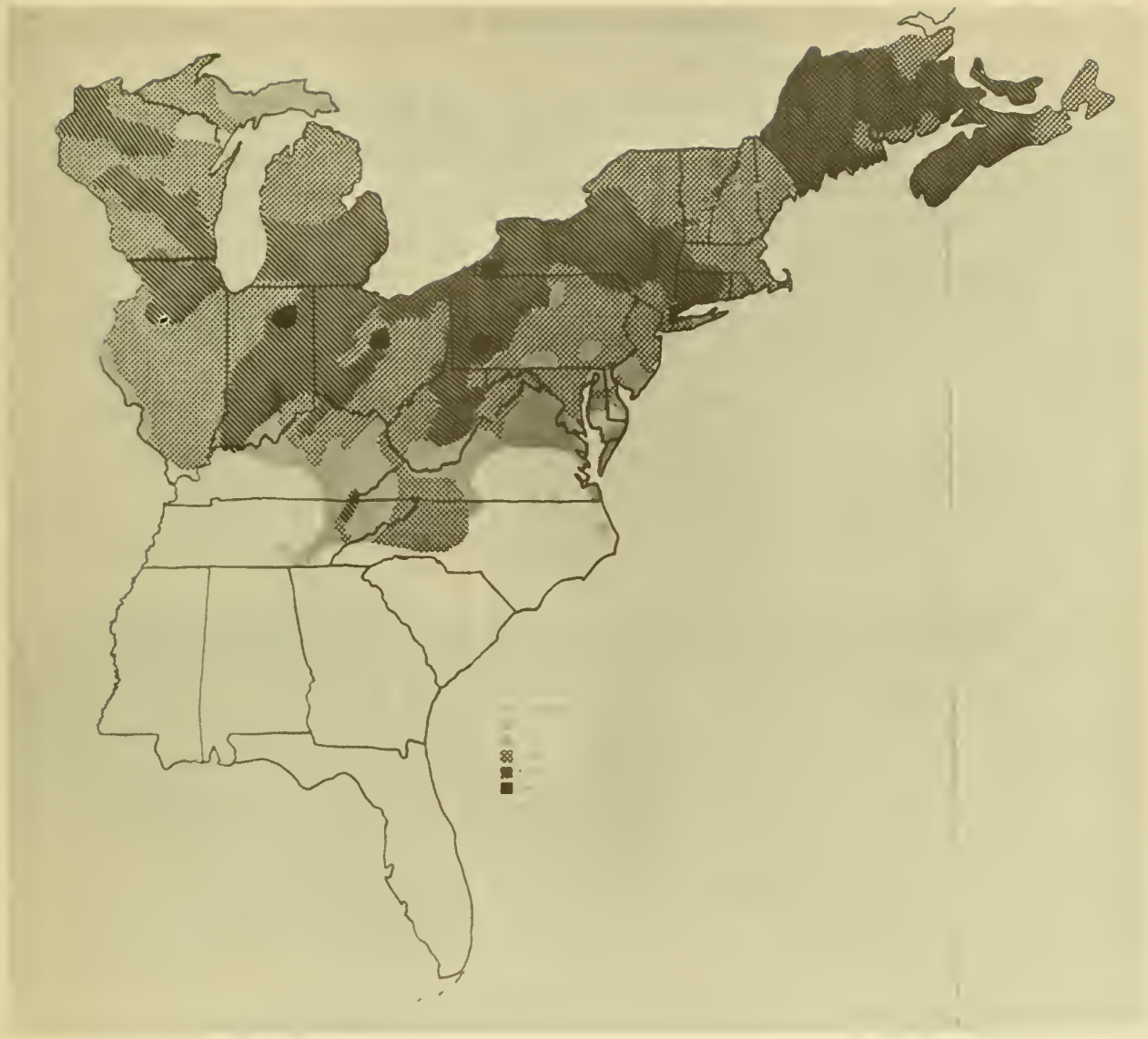

Figure 21. Song Sparrow distribution, 1966

FUTURE PLANS

It is planned to extend the Breeding Bird Survey in the summer of 1967 to include Ontario, Manitoba, and all States west through the Dakotas, Nebraska, Kansas, Oklahoma, and Texas; and by the summer of 1968, we hope to include the remainder of the continental United States and the accessible portions of Canada.

In order to achieve the best possible comparisons between years, as many routes as possible should be covered by the same observer who ran them in 1966. Coverage should be scheduled for approximately the same date insofar as possible.

ACKNOWLEDGMENTS

The Breeding Bird Survey would not have been possible without the wholehearted and enthusiastic cooperation of the coordinators for each State and Province. Their job was especially difficult in this first year of the Survey, but the splendid coverage that was achieved surpassed expectations. It is difficult to single out some coordinators for special mention since the efforts of each coordinator and, in many cases, several of the very capable assistants, contributed so much to the success of the Survey. We feel, however, that the following persons deserve special thanks for the tremendous amount of effort that they expended to assure that there would be fairly complete coverage of their State or Province. In many cases these individuals personally covered several routes in areas that otherwise would not have been covered: Ben B. Coffey, Dr. James B. Cope, Dr. Anthony J. Erskine, Thomas Foster, Dr. Katherine Goodpasture, Dr. George A. Hall, Mrs. Vera Hebert, Dr. Joseph Howell, Thomas A. Imhof, Dr. Burt L. Monroe, Jr., Dr. James F. Parnell, Rev. Samuel D. Robbins, Paul Schwalbe, Winslow Shaughnessy, William Turcotte, and Dr. Milton B. Trautman.

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